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OF THE

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OF

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TRANSACTIONS

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OF

QUEENSLAND.

1859 TO 1872.

BRISBANE.

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QUEENSLAND PHILOSOPHICAL SOCIETY.

ASPHYXIA.

A PAPER READ BEFORE THE QUEENSLAND PHILOSOPHICAL SOCIETY, IN JULY, 1859,

BY DR. BARTON.

Asphyxia—*a sphyxis*—means literally want of pulse; it is not, however, used generally by medical men in this sense, for though want of pulse is observed in death from any cause, yet the circulating system may not, in the first instance, be at fault. By Asphyxia we mean "the cessation of the respiratory functions, and the consequent retention of carbonic acid in the blood; if this be sufficiently prolonged; a condition ensues to which the name of asphyxia has been given."

For the better understanding of the subject proposed, we will first glance at the parts concerned in respiration—their structure; the chemical changes produced in the air and blood by the act of respiration—the nervous influence. The object of this preliminary enquiry will be seen when we enter on the second part of these observations, viz.:—Death by drowning—instances of death by asphyxia, method of treating persons drowned; Marshall Hall's ready method—how performed—its *rationale*—its success. It will at once be conceded that, beyond the scientific interest belonging to the subject, the knowledge of ready and rational means for restoring persons asphyxiated is of the utmost importance, for in the numerous cases of suspended animation—in the adult from drowning, and in the new-born babe from natural causes connected with the birth—a prompt application of the means about to be proposed may often save life.

The parts concerned in Respiration.—These are placed in the thorax chiefly, but extend to the mouth, they are the lungs, the heart—composed of two organs in one—the right and left sides, the trachea and larynx. The organs are protected by the bony frame of the thorax, and supplied with muscles, vessels, and nerves for the due performance of their functions Before speaking of the chemical changes effected in the air and blood by the act of respiration, we will take a sufficient glance at so much of the structure of the parts concerned, and circulation of the blood through them, as may enable us to understand the *rationale* of the ready method. The lungs, two in number, in the human subject, are placed one on each side of the thorax, and in the healthy state, occupy the whole space except that taken up by the heart and air vessels. The lungs are partly divided by long and deep fissures into lobes, the right into three, the left into two,—the lungs are composed of ramifications of the bronchial tubes, which terminate in intercellular passages and air cells, of the ramifications of the pulmonary artery and veins; bronchial arteries and veins, by lymphatics and nerves held together by areolar fibrous tissue, which constitutes the parenchyma of the lungs, this areolar tissue is composed of small divisions called lobules, this again consisting of smaller lobules, and these parts are formed by clusters of air cells in the parietes of which the capillaries of the pulmonary artery and pulmonary veins are distributed. The impure blood is brought from the right side of the heart by the pulmonary artery, which arises from the right ventricle, and dividing into right and left pulmonary arteries, pass to the root of each lung, the right dividing into three, and the left into two, one for each tube. These arteries dividing and subdividing in the structure of the lungs, terminate in capillary vessels, which form a net-work around the air passages and cells, and become continuous into the radicles of the pulmonary veins.

The blood rendered pure at this point, is returned to the left side of the heart, to be again sent through the general system, by the pulmonary veins. We have just said that the radicles of these are continuous with the capillaries of the pulmonary artery, they arise upon the parietes of the intercellular passages and air cells, and unite to form a single trunk for each lobe, these uniting, form two trunks which open into the left auricle. We have thus at a glance traced the blood (impure and poisonous to the human system) from the right side of the heart through the lungs, and returned purified and fit for circulating through the system to the left side of the heart by the pulmonary veins.

The change then has been from a dark coloured fluid—two or three waves of which circulating through the brain would produce asphyxia and death in a few minutes—to a bright red fluid circulating through every part of the body, and carrying the elements of increase, health, and strength, to every organ. How has this change been effected?

The bronchial tubes, which commence opposite the third dorsal vertebra by the bifurcation of the trachea and enter each lung at its root—divide into two branches, and each of these divide and sub-divide dichotomously to their ultimate termination in the intercellular passages and air cells. We have seen already that the capillaries of the pulmonary artery and pulmonary veins are continuous on the parietes of these cellular passages and air cells, and through these parietes these changes in the blood and air take place.

In tracing the bronchial tubes back to the point where they unite and form, we need only mention that this tube is composed of fibro cartilaginous rings, which, by their elasticity prevent its closure. Between it, however, and the base of the tongue is a complex and beautiful organ, the larynx, which must receive a passing notice, as its closure by the epiglottis has carefully to be guarded against, in endeavouring to restore persons by the ready method. The larynx has been described as a shot tube, having an hour-glass form—the upper and more prominent part—the thyroid cartilage (like a shield), forms in front the *pomum adami*. The lower, the cricoid cartilage (like a ring), narrow in front and broad behind—within are the organs of sound—the chordæ vocales. The aperture of the larynx is a triangular opening, closed during deglutition by the epiglottis during which act the larynx is drawn up under the base of the tougue, and the particle of food passes over it into the pharynx. The violent spasmodic action with which any substance is thrown out that may by accident get into the larynx, shows how carefully nature guards this important, complicated, and most beautiful organ.

We think that sufficient has now been said of the organs concerned in respiration. We next consider briefly the chemical changes produced by the act. "The blood comes to the lungs charged with carbonic acid, formed by the union of carbon and oxygen in the systemic capillaries; this, it imparts to the inspired air, at the same time abstracting from it a volume of oxygen, which is always as large, and usually greater. It appears probable that a part of this oxygen is made to combine with hydrogen set free in the systemic capillaries, and that the water thus generated forms part of that exhaled from the lungs. A sort of combustion of hydro-carbon thus appears to be continually going on in the body at large, the products of which are got rid of by the lungs; and this process is mainly, if not solely, instrumental in the maintenance of animal heat. The quantity of carbonic acid excreted by the lungs has been estimated by some experimenters at as much as 39,000 cubic inches in twenty-four hours. This amount of gas would contain 5148 grs, or 11 ounces (troy), of solid carbon. This, however, is considered too high: other very careful experiments gave 2616 grs,, or 5½ ounces of solid carbon, in the same time. Probably the mean of these, or about 8 ounces, is the true quantity.

Atmospheric air is a mixture (not a chemical compound) of 21 parts, by measure, of oxygen, and 79 of nitrogen, or azote, and we trace from 3 to 6 measures in 10,000 of carbonic acid. Air with 10 per cent. of carbonic acid will destroy life. Probably 1 per cent. would do so, slowly. Where, then, does all the carbonic acid of expired air go? It is taken up by the vegetable world—carbonic acid and water being the main *food* of plants, and by them the air is purified and made fit for re-inspiration; for though plants in their respiration, like animals, abstract oxygen from the air, yet the quantity is small, and much more than compensated for by the large quantity of carbonic acid they consume for food.

The changes in the blood of the colour, from the dark purple of the venous to the rich crimson of the arterial; of temperature, arterial blood being 2 deg. warmer; of density, the sp. gravity of arterial blood being lower; and the altered relative quantity of oxygen and carbonic acid in the two—these are the chief changes. The red particles of the blood are supposed to be the oxygen carriers, and though the exact difference between the two fluids is not, perhaps, known, yet we know that the oxygen is required for the formation of the new tissues, etc., as well as by its union with hydrogen—to form animal heat—as we have already seen, and that carbonic acid is a result of broken down and worn out tissue, poisonous to the system, and eliminated from it by the act of respiration—to be taken out of the air as the food of plants. Thus, by an interchange of the three gasses, oxygen, carbonic acid, and hydrogen, the animal and vegetable world is wonderfully and beautifully secured.

Next, we had purposed to take under review the nervous influence concerned in respiration, the pneumogastric—that wonderful compound nerve—the fifth (trifacial); these are the chief excitor nerves. Then the motor nerves, the respiratory nerves of Sir Charles Bell; the phrenic, or *int.* respiratory; the long thoracic, or *ext.* respiratory; and the intercostals—these, with the facial and spinal accessory also motor nerves connected with the act of respiration—we had intended to have described, from their origin in the medulla oblongata, or lower down from the upper part of the spinal cord to their distribution internally and externally to all the parts concerned in respiration; then endeavoured to show their functions separately and in concert; the effect produced by their

lesion in disease or by injury, and though this would be necessary in completing the subject, and would be full of scientific interest, and give us a noble field for discussion, yet, for brevity sake, and because it is not essential to the practical purpose at which we are aiming, we, unwillingly on this occasion, pass it over and hasten to the second division of the paper as originally proposed.

Passing over the next point—the nervous influence connected with the act of respiration—as it would lengthen out these remarks too much, we hasten to the second division of this paper as originally proposed, viz.:—

Death by Drowning. — Persons drowned present only one example of death by asphyxia, for there are many ways by which air to the lungs may be denied, and death ensue. Thus, air may be prevented from finding entrance into the lungs by stoppage of the mouth and nostrils (smothering); by submersion of the same inlets in some liquid (drowning); by mechanical obstruction of the larynx or trachea from within, as by a morsel of food (choking), or from without as by the bowstring (strangulation) or by forcible pressure on the chest and abdomen, or by paralysis of the respiratory muscles from injury to, or disease of the spinal cord or nerves; but as the object of this paper is a practical one and the endeavour that it shall be useful; we will confine ourselves to the one manner of producing asphyxia—by drowning.

A person falls into deep water—what happens? In the first instance vain attempts are made to respire—at each time the drowning person rises to the surface; a portion of air is received into the lungs, but owing to the mouth being on a level with the liquid, water also enters and passes into the fauces. A large quantity of water thus usually passes into the mouth, which the individual feels himself irresistably compelled to swallow. The struggle for life may continue for a longer or shorter period, according to the age, sex, and strength of the person, but the result is, that the blood in the lungs, becomes imperfectly ærated, and the individual becomes exhausted. The mouth then sinks altogether below the level of the water, air can no longer enter into the lungs—a portion of that which they contain is expelled, and rises in bubbles to the surface: an indescribable feeling of delirium, with a ringing sensation in the ears, supervenes—the person then loses all consciousness, and sinks asphyxiated. Before death, and while the body is submersed, frequent attempts are made to breathe, but at each effort air escapes from the lungs; so that these organs may, according to the duration of the struggle, become more or less emptied, and even be found collapsed after death. During the state of asphyxia dark-coloured blood is circulated—convulsive motions of the body follow, and the contents of the stomach are sometimes ejected prior to dissolution. There is not the least sensation of pain; and, as in other cases of asphyxia, if the individual recover, there is a total unconsciousness of suffering during the period when the access of air was cut off from the lungs. I state this (Professor Taylor adds) from having accidentally experienced all the phenomena of drowning, up to the complete loss of sensibility and consciousness.

How long can a person remain beneath the surface of water without becoming asphyxiated? After what period of entire submersion of the body may we hope to resuscitate a person?

These two questions are very important, and require answer.

On the best authority it is stated that perfect insensibility has supervened after one minute's submersion, and it is probable that in most cases a few moments would suffice for the commencement of asphyxia, and it may be believed that asphyxia supervenes without varying materially with the individual, in the course of one or two minutes at the farthest. It has been found that amongst sponge and pearl divers, not one could sustain entire submerson of the body for *two consecutive minutes.*

But says Taylor, asphyxia is not synonymous with death, for though the insensibility which is the result of submersion, will give to a body which has been immersed only a few minutes, or even seconds, the characters of apparent death, yet we are not therefore to suppose that the person is irrecoverably lost, or to desist from applying all the means in our power to restore animation.

There are cases on record where after entire submersion for one, two, five, ten, or perhaps *fifteen* or even twenty minutes, the persevering prompt application of the suitable measures has resulted in success. Indeed cases of alleged recovery after half an hour, and even three quarters of an hour have been reported.

This question of the great variation of time, in successful and unsuccessful attempts at resuscitation, is an interesting and important one, and might be discussed at great length. It is however foreign to our present purpose to stop here, and we will pass on at once to Marshall Hall's ready method of treating persons asphyxiated—and this is equally applicable to persons drowned; or infants asphyxiated during the birth; indeed, probably many more infants' lives have been saved than adults by it, the former class being more numerous and often in more favourable circumstances for its application than the latter.

We will give his rules entire, premising that they could not in this town be made too public, and ought, like the directions of the Royal Humane Society, in London, be posted in suitable places for general information.

Marshall Hall divides his rules into two sections: first, to restore respiration; second, to imitate respiration. The rules in the first do not differ altogether from those previously in force. Those in his second are his own, and

constitute the ready method. To restore respiration—

1. Send with all speed for medical aid: for articles of clothing, blankets, etc.

2. Treat the patient on the spot, in the open air, exposing the face and chest freely to the breeze, (except in too cold weather).

3. Place the patient gently on the face (to allow any fluid to flow from the mouth).

4. Then raise the patient into the sitting posture, and endeavour to *excite* respiration—by snuff, hartshorn, etc., applied to the nostrils—by irritating the throat by a feather, or the finger—by dashing hot and cold water *alternately* on the face and chest. But if there be no success, lose no time, but *to imitate respiration.*

5. Replace the patient on his face, his arms under his head, that the tongue may fall *forward* and leave the entrance into the wind-pipe free, and that any fluid may flow out of the mouth; then

1. Turn the body gradually, but completely on the *side and a little more*, and then again on the face, alternately (to induce inspiration and expiration).

2. When replaced, apply pressure along the back and ribs, and then remove it (to induce further *ex*piration and *in*spiration) and proceed as before.

3. Let these measures be repeated gently, deliberately, but (efficiently and perseveringly) *sixteen times* in the minute only.

To induce circulation and warmth whilst continuing these measures (artificial respiration) rub all the limbs and the trunk *upwards* with the warm hands—making *firm pressure* energetically; also replace wet clothing by such others as can be procured.

Omit the warm bath until respiration be re-established."

We had now to speak of the *rationale* of this method and its success—but the directions of the great man who penned them are so clear, simple, and distinct, that they seem to speak for, and explain themselves. We will, however, contrast the above with an extract from a little book, an excellent authority, on the same subject:—Shaw says: "The method most usually pursued is by compression of the patient's chest and abdomen. The air is thus forcibly expelled, and the ribs rising, on the removal of the pressure, by their own elasticity, effect a fair inspiratory draught. Two operators are necessary—one to compress the chest, and one the abdomen—both must be careful to act in unison, and, should the patient be of large frame, it will be needful that they have powerful arms."

Let any one look at the human larynx (which we have already described), its form, the triangular opening of the glottis, and the relative situation of this to the base of the tongue and epiglottis; and say whether the one mode of proceeding is not simple, scientific, and beautiful; the other, barbarous, unscientific, and worse than useless;—the one eventuating (if within the bounds of possibility) in recovery, the other tending towards, and hastening, and ending in, death. In the ready method the patient is placed on his face, with his arms under his head. In this posture the lungs are freed from part of the fluid, which pours out of the mouth. This position, too, causes the tongue and epiglottis to fall forward, and thus leaves the opening into the glottis free for the air to enter; for as we have seen, in speaking of the chemistry of respiration, that a very small quantity of carbonic acid gas imprisoned in the blood will cause asphyxia and death, so the *rationale* of the treatment must be to get a supply of pure air into the lungs, which, as we have already seen, parting with its oxygen, will be *ex*pired, charged with the poisonous carbonic acid. But, in the process described by Mr. Shaw, the patient must be on his back. Thus, no fluid will flow from the lungs, and, the tongue and epiglottis falling, by their weight, back, will tend to close the opening into the larynx, and prevent the entrance of air. The turning too of the body at regular intervals on to the side and a little more, and when replaced applying firm pressure along the back and ribs; end then removing the pressure, are the simple and self-evident aids to the weight of the body, and the elasticity of the framework of the thorax, and the lungs themselves, in resuscitating the person asphyxiated.

How different the other treatment—the two assistants, one for the chest, one for the abdomen—"and men who must have powerful arms too"—to endeavour by an exertion of their own muscular power (with little assistance from their heads apparently) to imitate by forcible compression the quiet, beautiful act of respiration.

Its success.—The late widely lamented Dr. Marshall Hall lived long enough to see his ready method for restoring persons asphyxiated adopted wherever his writings were known, and knew that by its general use hundreds, nay, thousands of lives had been saved.

It is unnecessary to go farther than this town to show that by it many lives have been saved, for it is within the knowledge of the writer that asphyxiated persons have been restored to life by the prompt use of the ready method.

Nor can we overrate the importance of the subject, or value too highly, or endeavour to spread too widely a thorough knowledge of it; for a prompt application of this ready method may enable any one of us to save a valuable life.

Dr. Marshall Hall, by publishing his simple and beautiful rules, gave to us the most valuable legacy perhaps of his time, and which should be by us as widely disseminated as possible; and so answer the benevolent intention of the giver, and at the same time extend his name and fame in all periods and places.

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VENTILATION.

A PAPER ON THE VENTILATION OF BUILDINGS, READ BY MR. TIFFIN BEFORE THE QUEENSLAND PHILOSOPHICAL SOCIETY, ON TUESDAY EVENING, JUNE 5TH, AT THE COMMITTEE ROOMS OF THE BRISBANE HOSPITAL.

The term ventilation is well understood by those who have thought on the subject, but generally partakes of another signification by the mass of individuals, who imagine that ventilation means a thorough draught. without regard to the quality of the draught, so long as it does not smell disagreeably.

The meaning of the ventilation of an apartment has often been mistaken by the quasi-scientific, which has led to many disastrous failures in the prosecution of countless pet schemes, by their merely devoting their efforts to the ridding an apartment of its foul gases, and totally neglecting to supply their place by the nicely proportioned nitrogen and oxygen indispensible for the healthy and enjoyable exercise of the animal functions. Since so many and such costly and fatal errors have been committed by those entrusted with the artificial providing of pure air round, and in the permanent tents of our modern huge encampments ; I say, "encampments" because our towns and cities are on the primary model of the aboriginal camp, which was removed so soon as the neighborhood became uninhabitable from the accumulation of excrement and domestic detritus which tainted the pure air. Civilization having reversed the operation, it becomes necessary now to remove the filth and to leave the camp and render it as sulubrious as was the aboriginal camp on the first morning when its blue smoke shot up a "pillar of cloud" through the dew-glistening foliage of the primeval wood. Since, I say, so many mistakes have been committed in this matter, I will on the outset endeavour to state what I conceive to be thorough ventilation.

Thorough ventilation I conceive to be. 1st. The dispersion of all unhealthy gases and the causes from which they arise. 2nd. The supply of pure untainted atmospheric air. 3rd. The warming of that air when too cold. 4th. The cooling of that air when too hot. It may be necessary here to put a proviso. Let it therefore be understood that the ventilation provided for one individual will not answer for onl hundred nor *vice versa ;* here, then, is a difficulty that is only removable by the unlimited use of means, consequently the unlimited use of wealth, as I trust will appear before the close of this paper. Of the four conditions on which depend thorough ventilation the first, viz :—" The dispersion of all unhealthy gases and the cause from which they arise" is unquestionably that which deserves the greatest attention and which requires the most diligent consideration, it being the foundation, and, in fact, embracing the whole four conditions, and without which no pure air is obtainable by any means whatsoever. Consequently it appears that "thorough ventilation" is inseparable from that great scientific topic " thorough drainage," a topic that seems incapable of ever being drained dry.

Scientific treatises of any kind are but lifeless corpses unless we can introduce them to our persons and to our homes for their benefit in some measure ; therefore I will endeavor to apply these remarks which are hackneyed, threadbare, and tiresome in every part of the world, but nevertheless here they may be of some slight service, if they but tend to feed the flame of this branch of science, without adding to its lustre or volume.

We will take our nascent city, Brisbane, as it is, without a current of fresh water, and picture what sort of air we might have to breathe should that unusually copious rain-fall of our district be withheld for one summer. I will give that beautiful stream, the Brisbane, its due ; it is uncontaminated by drainage, but the four boiling down places give out some amount of noxious and unfavoring gales, and pour down upon it some viscid stream of "leafy green," and the hanging woods—those gorgeously festooned scrubs—drop their odorous (when decayed) blooms, adding their little mite towards the vitiating of our river. It is not the water, but what the water leaves, that

imbues the air; the water, I admit, absorbs far more of the noxious carbonic acid than its own bulk, but its deposits a finely comminuted mud, which when the tide is out, "doth fill the air" with fumes repulsive to tender olfactories.

I fear my essay will dwindle into a compilation now, for I must confess to being compelled to take for granted many scientific facts that form the basis of it. To show what sort of air may be expected from our mud banks, I adduce the testimony of Dr. Angus Smith, "who has devised means of learning the relative amount of decaying animal and vegetable matter existing in the air under different circumstances, and found, as compared with the purest air he examined that of Lake Lucerne—that at the forest near Chamounix, the amount of organic matter was double, evidently owing to the decay of the leaves; in North Lancashire, the same. In the fields near large towns, as London and Manchester, there is between nine and ten times as large a quantity as at Lucerne. In the purest parts of London there is double as much as in the adjacent country; although this is immediately reduced by the purifying influence of a thunderstorm. Over the putrid Thames, in the warm weather, there is double the amount of that in the purer parts of London, and four times as much as in the Highgate fields. Manchester is nearly as bad. In close dwelling-houses the air is still worse; and in open pig sties it is so charged with putrifying effluvia, or what may be truly termed animal stink, that there is absolutely eighty times the amount that is found in the pure air of Lake Lucerne."

I adduce, for further evidence, the testimony of another authority, although anonymous, who relates his adventures in search of the odoriferous in a somewhat joyous strain, evidently well pleased with his discoveries. But before I quote this authority I would mention that besides the viscid mud of the river, we have numerous water-holes, so called; but I question whether they contain much water, and if it is not chiefly something else mixed with a little water; and these mud water-holes as loudly proclaim their whereabouts; and have we not soil pits and cul-de-sac drains, in every little nook that looks snug and retired, reeking with pestiferous breath which our anonymous friend loves to analyse. These are his words:—

"I like to visit cesspools and sewers, and to examine drains and foul ditches. People marvel at my pursuit, but there is a grim satisfaction in it that I would not lose. There is a grim fascination in that which is terrible or mysterious, and to humanity, typhus and cholera are like the enigma of the Sphinx, to be solved on the penalty of death. Whenever the microscope shows me the *paramecium* and *annellidœ*, I know that I am on the track of the enemy—wherever my lead paint is blackened I know that his most dangerous ally is at hand. This is a gas—the same as that evolved from rotten eggs — deadly in itself, pestilential when combined with organic poisons. It is active in the malaria in India and Ceylon, and in the Campagna of Rome; it forms the subtile emanations which follow the course of rivers, and it enters into the exhalations from stagnant pools and certain marshes. Reeking from cesspools it blanches the cheek and taints the blood of squalid poverty, and may sometimes be found lurking in the houses of the rich. Near to the churchyards it is often a messenger from the dead to the living, and bears its summons faithfully. Sulphurated hydrogen is its name. Its origin in the water is generally a salt containing sulphur, this salt being decomposed by putrefactive action. Chlorine instantly destroys the gas, muriatic acid being formed and sulphur disengaged."

In passing, I may mention the value of this excrementitious matter, and that Alderman Mechi has just issued a work on the nasty stuff in which he clearly proves what unfailing crops of vegetables grasses, and cereals, can be obtained by its use. He states that it can be rendered perfectly inodorous before being spread, and that in China it is mixed with fine loam and retailed in cakes, much like oil-cake I presume. I would state here, in further proof of the value of this matter as a manure, that I was acquainted with Mr. Shoebridge, in Tasmania, who does the whole of the work performed by "nightmen," in the city of Hobart Town, and uses the proceeds on his own farm. He told me that he always planted the English potatoe, and never failed to have a large crop: and when other farmers were grumbling at the failure of crops he was reaping a large profit from his night-soil fed potatoes. I make these remarks here, knowing that in Brisbane night-soil is taken away and buried, or left to evaporate its ammoniacal gases on some green hill. I may throw in the following results of experiments made with a view to the perfect deodorisation of sewage by Drs. Hoffmann and Frankland, for the Metropolitan Board of Works, London. The three most perfect agents were perchloride of iron, chloride of lime, and lime. The proportions were, to 7500 gallons of sewage, half-gallon of the perchloride, 3 lbs. of choride to the same quantity of sewage and one bushel of lime. In two days the sewage, deodorised by lime became tainted, in three days that by the chloride; and after nine days that by the perchloride remained unaltered. The perchloride at the time the experiments were made, cost exactly half that of the lime, the chloride costing two-thirds that of the lime.

I should not dwell so long on this part of the subject, but that I said at the outset it is the foundation of all ventilation as the following extract will show, always supposing the statements to be correct, as I cannot vouch for them by experience:—

"Where respiration is performed naturally, there are about 18 respirations in one minute, 1080 in the hour, and 25,920 in the 24 hours; and that by each respiration a pint of air is sent into the lungs, that is 18 pints in a minute, or in the hour more than two hogsheads, and in the twenty-four hours more than 57 hogsheads, the effect impurity may produce is evident. When the body is in a state of health, there will be 72 pulsations of the heart in a minute. Every pulsation sends to the heart two ounces of blood. Thus, 144 ounces are sent for purification to the lungs every minute. In one hour there are sent 450 pints; in 24 hours, nearly 11,000 pints. The blood performs a complete circuit in the system in 110 seconds. These figures show how great is the need for the air we breathe to be pure and wholesome."

Now it must be evident that until those causes which vitiate the air be removed, ventilation remains an impracticable scheme; and the faster the streets get the yawning gaps filled in with building, the more difficult it becomes to ventilate, for wherever there is a cul-de-sac formed by closely erected houses, there will hang the germs of typhus and influenza ready to germinate whenever their time comes. I have also been more anxious to bear upon this branch of my subject since reading the report of the New South Wales Government on the state of the working classes, which gravely sets forth that most of the degradation, illness, and misery of those classes arise from the ill-ventilated drains, neighborhoods and dwellings where they reside, aud urges upon the Executive the necessity of reforming the deplorable state of their homes.

Having, as far as I was able, without entering into the minutiæ of drainage, cleared away the foul air outside of our dwellings, it is necessary now to to walk inside and renovate them; we therefore now come to the second proposition, viz.: The supply of pure untainted atmospheric air. The principal cause of bad air in rooms is the retention of the expended air from the lungs, that is, the carbonic acid, which is, you all know, a heavy, colourless, inodorous gas, incapable of sustaining combustion, or respiration. Now the function of ventilation here is to dispel this gas. In its hot state, as it emerges from the nostrils, it is comparatively light, and has a tendency to rise, whereas, as soon as cool, it falls like lead through the pure air, hence so many schemes of ventilation have been tried with a view to catching the warm gas and delivering it to the all-absorbing atmosphere: hence have arisen syphon ventilators, valve ventilators, revolving ventilators, and a host of others. Now there are certain subordinate conditions in ventilating, that require no mean consideration, in reference to the prevailing state of the atmosphere, and here the aspect of the building has an important influence. There may be long prevailing winds, and these may be in many directions and of various temperatures; under such circumstances ventilation may be overdone.

Again, there may be a dead calm, close and sultry; this doubtless is the time of all others when the want of ventilation is unmistakeably felt. Certainly under such circumstances no other than some mechanical aid can sweep away the effete, sluggish, and noxious gases. It is in crowded churches, balls, and assembly rooms, that this state of the atmosphere becomes so fearfully oppressive, and I would state, as my opinion. that in such a case no building enclosed by walls after our usual manner could be thoroughly and satisfactorily ventilated. The only way to overcome such a difficulty would be to have winter halls and summer halls, and thus regulate ths wind. The following plan has been adopted in ventilating some schools, which were of course supposed to accommodate only a restricted number:—

"The supply of fresh air to the school is from the heating chambers (as they may be called) connected with the stove; and that the fresh air therefore enters the rooms at a very high temperature, far higher than that of the vitiated air ascending from the children. The consequence is, that a large volume of fresh air, thus rendered specifically lighter than the vitiated air, is continually rushing up into the upper part of the room, and as it cools, descends till it meets with and greatly dilutes the much smaller volume of vitiated air that is generated in the room. So considerable is this dilution that the air breathed by the children in a school warmed by this apparatus is found to be sufficiently pure for health and comfort, and, in fact, as pure as we can probably hope to obtain it in a closed building."

It will be observed that in this plan no air is admitted into the chamber but through the heating apparatus, a case that would by no means answer in every state of the atmosphere.

Before I conclude I will give an outline of a system of ventilation which has been adopted on the continent and which to my mind is the most complete that has ever yet been tried. But it appears only feasible when applied to the partiticular case, viz: the hospital with its stated number of inmates; and who shall tell what humane results shall follow from its general introduction.

I would here state in few words what I conceive to be the simplest and most efficient means of freeing our own chambers and churches of their vitiated air as they are, and with the means at our command. I have gone into the necessity of outside drainage rather lengthily, and spoken of the utter hopelessness of its ever being accomplished without a running stream of water. But we can rid our chambers of foul air by having the floors perforated in different places, so that should the carbonic acid fall cold to the

floor it may run through, and be absorbed by the moist earth beneath, or by the lime that may be spread under the floor.

Again, the ceiling in one storey buildings might be made into a sort of cullander, to sift the hot vitiated air from the fresh. Sash windows, what builders term double hung, apparently an unnecessary process, but it only means that both the sashes are hung to slide. The top sash can be regulated to any aperture, and this is clearly one of the simplest ways of getting a little fresh air. Fire places to draw some of the foul air off are always of use, even supposing the fire is never put in them. Rooms in the form of a cul-de-sac are great abominations, and it is almost impossible to ventilate them without going to an amount of trouble and cost that few are inclined to go to. If possible they ought to have an exit opening as well as entrance door.

I confess that it is of great service to have doors and windows to admit the air, yet very often in this climate when windows are thrown open the hot sun pours in and destroys the effect, but venetian blinds remedy this evil where they can be afforded. It is a notable fact that the people of this colony adopt the wise plan in their domestic arrangements, and absolutely live in the verandah in the warm weather, and go indoors in the cold; if they did so in public arrangements there would be less outcry at bad ventilation. I may be met by some saying that architects and builders ought to build proper places, but I reply that architects and builders are not allowed. They only carry out the *ideas* of those for whom they work and put them into "ship-shape." Let any builder or architect attempt to innovate, and see if he be not immediately elevated to the unenviable post of theorist. Why, the very character of the man is forfeited. He is emphatically a practical man! but this is not exactly the tone for a philosophical society paper, therefore I must come down to the dry details of the system of ventilation, which I stated previously had been adopted in some of the continental hospitals; and as it embraces the two last conditions of ventilation, viz., the warming of apartments and the cooling of them, I refrain from making further mention of those branches than is set forth in the following scheme. The system originated with Dr. Van Hecke, and was brought into operation at Brussels for the Belgian government. Of the application of the Van Hecke system to the pavilions of the Hospital Beaujon, a highly favorable report was furnished by a commission appointed by the French Government of which Dr Grassi was the reporter. The following is taken from a translation of the report by Mr. J. Bonomi:—

"The warming of the pavilion No. 4 of the Hospital Beaujon, is performed by means of a calorifère stove situated in the cellar floor. Air is conveyed to this stove by a cylindrical channel of zinc, 75 centimètres (2 ft 5½ inches) in diameter, which, after running horizontally through the vault is received into a vertical shaft of masonry opening out in the garden at about 2 metres (about 6 feet 7 inches) above its surface; from this source the air is derived.

"After the air has passed through the tubes of the calorifère, and become warmed, it enters a large pipe, to be distributed by it in the three wards, (one above the other) before, however, reaching them, it passes over a pan of water to supply it with a suitable quantity of moisture By this arrangement the air transmitted to the wards is derived exclusively from the garden and not allowed to mix with the air of the vault.

"Instead of permitting the air to circulate in the colorifère it may be sent to the wards in a direct course, which bears the same relation to the channel of the calorifère that the chord does to its arc. At the commencement of the calorifère tube there is a moveable register for the purpose of giving such a direction to the air as may be required, either for warming it, or allowing its use at its natural temperature.

"The register, when partly opened, may even permit a mixture of the two at different degrees of temperature, and moderate the warmth of a ward for the moment become overheated.

"The air conduit (or pipe) enters the ground floor ward in its centre at the floor level, through the middle of a cast iron drum of four vertical sides, furnished with perforated doors for admitting the air into the ward. The tambour or drum incloses some wire shelves on which linen may be placed, and drinks for the patient to be warmed.

"The air pipe debouches on the floor level through an opening of 75 centimetres (2 feet 5½ inches) diameter, in which is inserted a vertical tube of 60 centimetres (1 feet 11½ inches) diameter, rising to the first floor; between these two tubes there exists an annular space permitting a portion of the air to be arrested on the ground floor. Thus the air introduced is divided into two portions; one admitted to the ground floor, the other continuing upwards for the use of the upper floors. A register, regulated by a quadrant, permits the reduction of the section of the tube and of varying the volume of air for each of the floors. If the register is entirely closed, the whole of the air would be arrested on the ground floor; by opening it, more or less, the air for the two upper floors is increased at pleasure.

"On the first floor there is an arrangement like that on the ground floor a register for stopping a certain volume of air, and for allowing the rest to rise to the second floor, where the second column terminates, and a tambour only exists, in every respect resembling those of the lower floors. Thus fresh air, serving both for warming and ventilating, is admitted into the centre of the wards, entering through wide

openings, so as not to acquire a great velocity and produce disagreeable currents.

"The air which has been harboured in the wards escapes from them through four evacuating channels in their corners or angles, a number too limited, in my opinion, but the pavilion being already built where the system of ventilation was adopted to it, a greater number would have occasioned a considerable outlay for cutting chaces in the walls, or for placing the channels on the wall surfaces with a very disagreeable appearance.

"The three channels at each angle of the upper ward, and which correspond with the three wards, rise side by side vertically to reach the loft, where they are received into a horizontal zinc pipe, one at each of the four corners, which unite in the centre of the loft in a tambour, capped with an evacuating cylinder of zinc, 75 centimetres (2 feet 5½ inches) in diameter. At the intersections of the air-escape channels from the wards with the receiving channels of the left, registers are fixed, by which the openings may be regulated, and, consequently, the draft or extraction from each of the wards.

"The air from the wards has besides the evacuating channels above-named, an exit for escape through the water-closets by an opening in the ceiling, which also communicates with the channel in the loft. The air from the ward, entering into the water-closets through an opening in the lower part of the door, rises towards the evacuating opening in the water-closet ceiling sweeping through and carrying away in its course all smell. The ventilation is not effected through the water-closet basins, as at La Riboisiére, the seats being closed, and the ventilation acting exclusively upon the atmosphere within the water-closet; it is quite sufficient, and in no hospital have I found the water-closets so completely rid of smell as in the hospital Beaujon.

"By way of concluding what refers to the introduction and exit of air, I must mention a source of pure air considered as accessory, which, however, is not unimportant.

"On the ground floor at the entrance to the cellaring, is placed a small steam-engine, of which I shall presently speak. The smoke-flue from its furnace, united to that of the calorifère stove, is surrounded by a concentric enclosure, the lower end of which is open to the outer pure air, and draws it in through its orifice in the garden. This air circulates in the annular space round the smoke-pipe, in contact with which it becomes warm as it rises to the top of the building. This air flue is situated in the thickness of the wall separating the staircase from the wards; at the level of each story it presents three openings, one into the ward, one towards the stairs, and the third into the two-bedded room.

"These openings afford a passage for the warm air during winter, in the summer season it is allowed to rise to the upper part of the building where it disperses itself, but Mr. Van Hecke was desirous to turn this warm air to account by causing it to enter a loft used as a drying chamber.

"When the upper orifice of this air funnel is closed, as is the case in winter, the warm air diffuses itself in the wards, and in the staircase, of which it keeps up the warmth. In summer wheu the upper orifice it entirely open, the smoke-flue draws upon the air within the wards, and thus produces an increase of ventilation.

"Such is the channel system for the passage of the air derived from the garden, and finally escaping through the common flue. Now let us consider the moving power.

"I have before mentioned the small steam-engine at the entrance to the cellaring; it is intended to keep in motion a ventilator, which, in the first instance, Mr. Van Hecke had placed in the upper part of the tubing within the flue or chimney of the loft.

"A band or strap transmits the movement from the ground floor to the loft; the ventilator there produces a suction draft from the air of the wards. The apparatus of Mr. Van Hecke has produced ventilation by suction by mechanical agency. Since it was fixed, an important addition has been made to it. Mr. Van Hecke has placed a second ventilator, identical with the first, in the lower indraft channel, where the column of air takes its rise within the vault. On connecting this ventilator with the machine, it drives into the wards the air which it inspires from without, and thus produces a ventilation by injection analogous to that produced by the apparatus of Messrs. Thomas and Laurens, at the hospital La Riboisiére.

"In this manner the apparatus is arranged to allow of ventilation by suction, on putting the upper ventilator in motion, or by injection when the engine is in connection with the ventilator situated in the lower part of the building; the change being effected simplv by the band which transmits the motion, an operation requiring but a few minutes.

"The ventilator of Mr. Van Hecke is composed of two fans or blades, fixed to two stems which are inserted perpendicularly on the axis of rotation and inclined from fifty to sixty degrees. A peculiarity distinguishing this ventilator is, that the inclination of the fans is not constant, but varying with the speed of the rotary movement.

"The boiler of the engine warms the office on the ground floor, in which are arranged pans for poultices, and a warm linen closet. A portion of the steam, after giving motion to the engine is sent to the upper floors, where it heats the water required by the patients; but the greater portion which might be usefully employed, is for the present wasted."

"Dr. Grassi then proceeds to show how the

effects of the system are indicated by an anemometer connected with a contrivance of Mr. Van Hecke's. He then adds :—

"In order to complete the description of this system of warming and ventilating, I have to notice an apparatus not yet fixed, but which is now been constructed by Mr. Van Hecke, and to be placed within the stone built channel, which from the cellar leads into the garden for air. This apparatus is intended to cool the air in summer, on its way to the wards. It consists of two cylinder placed horizontally one above the other, at 1 m. 50 s. (4 feet 11¼ inches) apart on the axis of the upper cylinder is a pulley to receive the movement of the axle-tree. The under cylinder is plunged into a trongh of water, which may be obtained of the the temperature of well water, or be cooled artificially by pieces of ice, should it be requisite. Endless bands pass from one to the other of these cylinders, which revolve simultaneously. The air circulating in the channel is forced to pass over the constantly moist bands and thus acquires a much lower temperature.

"The use of steam power, we may add, is only requisite to Van Hecke's system on a large scale. In ships and elsewhere, where manual labour can be easily or economically applied, or is sufficient for the purpose in view, no steam power is necessary to ventilation on this plan; and in dwelling houses the ventilator has even been put in action by clockwork and weights."

After experiments incontestable proved the superiority of this system of ventilation by pulsion.

W. C. BELBRRIDGE, PRINTER, BRISBANE.

COTTON AND QUEENSLAND.

A PAPER ON "COTTON AND QUEENSLAND," READ BY MR. W. BROOKES, BEFORE THE QUEENSLAND PHILOSOPHICAL SOCIETY, ON TUESDAY EVENING, 3RD JULY, 1860, AT THE COMMITTEE ROOMS OF THE BRISBANE HOSPITAL.

It seems almost impossible to over-estimate the value of cotton as contributing to the comfort and health of the human race. From ancient times the teeming populations of India and China have used it as their principal clothing material. They appreciated its utility when our ancestors deemed themselves fashionably attired when invested with a new coat of blue paint. Even at the present time the consumption of cotton, vast as it is, has by no means reached its limits. To cite but one of many illustrations, let us look at Russia, the largest European empire, representing a population of 70 millions. The author of "A Journey due North," though of a cool temperament, writes with obvious surprise, "I can state, from my own personal experience, that I have played many games of billiards with even Russian officers (you can't help seeing up to your opponent's elbow at some stages of the game), and that, if they possessed shirts, they either kept them laid up in lavender at home, or wore them without sleeves."

I confess that my faith in the perfectability, or at least, in the ultimate respectability of human nature would be strengthened, could it be truthfully affirmed, either as a fact or a probability, that every man living on the face of the earth had a good cotton shirt on his back, and also a decent reserve stock to ensure a clean one when necessary. This is a consummation to be wished for devoutly, as a basis for, or as a sign of, universal elevation in other respects.

The import of cotton into the United Kingdom in 1859, was 2,828,000 bales, of which 2,085,000 were American, or from the States; 510,000 East Indian, and from Brazil, the West Indies, and Egypt together, only 233,000 bales. This is an almost inconceivable quantity, and would seem sufficient to satiate the most ravenous manufacturing appetite. It is not; our cotton manufacturers are not content with only 3,000,000 bales. They are not usually considered a class of persons inordinately imaginative; they are said to keep a steady and somewhat prosaic eye to business. But they are afraid of being obliged to accept a smaller quantity, and are in keen search of fresh or additional sources of supply. They sensitively feel that they are far too dependent upon a nation, in many important respects a foreign nation, though speaking the English language, and holding a kindred relation. It is not with cotton as it is with wool, which after cotton is the most important material for textile fabrics. We regard with a not altogether unreasonable complacency the quantity of wool exported from Australia, and it is not intended to say a word against this feeling of satisfaction, but rather to strengthen the grounds on which it rests, by increasing the export of wool as much as possible. Australia might cease to supply wool; the results, though undeniably seriously inconvenient, are not to be compared with the wide-spread, direct, and immediate ruin ensuing upon the stoppage of the supply of cotton from the United States. On this point Mr. Ashworth, in a paper read before the Society of Arts, has the following remarks:—"The entire failure of a cotton crop, should it ever occur, would utterly destroy, and perhaps for ever, all the manufacturing prosperity we possess; or should the growth in any one year be only one million instead of three millions of bales, the manufacturing and trading classes would find themselves involved in losses which, in many cases, would amount to irretrievable ruin—millions of our countrymen would be deprived of employment and food—and, as a consequence, the misfortune would involve this country in a series of calamities, politically, socially, and commercially, such as cannot be contemplated without anxiety and dismay."

The United Kingdom, within her own island limits, cannot grow cotton at all; but she can and does grow more wool than she receives from Australia. This circumstance gives to the cotton supply question a heightened and peculiar interest, and no wonder if there should be strenuous and anxious efforts to ascertain whether the supply cannot be induced from less objectionable sources. It is a magnificent problem; could Au-

stralia solve it, she would rank high indeed in the estimation of our parent country. It is for Queensland a matter of the most stimulating importance, for it appears easily possible for us to say to our gracious Queen, "We will, so far as cotton is concerned, stand in the same relation to the United Kingdom, as that hitherto occupied by the United States; we can and will grow quite as much regularly year by year; and we are resolved to completely remove our further national exposure to the remark, though unfriendly, difficult successfully to rebut, that Britain has not been thoroughly honest or consistent in that policy, which, while it redeemed the slaves in British dominions at the princely ransom of £20,000,000, could yet passively consent to have this glorious act bedimmed by allowing a manufacturing interest of so large and vital importance to grow up servilely dependent upon the continuance of slavery in its most undisguised abominableness in another nation." What a future for Queensland opens to the mind when contemplating the cotton question in this light: and that we are building no castles in the air, but are proceeding upon ground in every way safe and tenable, it will be the object of the following divisions of this paper to show.

2. The whole of Queensland lies within those degrees of latitude where the cotton plant grows luxuriantly. The coast line from Brisbane to Rockhampton is between the same degrees of latitude as are those parts of Africa Dr. Livingstone speaks of, where cotton is so abundant that "the trees are cut down as weeds." It is mentionable that he further states "that as far as he could learn, this cotton was the American, so influenced as to be perennial." This geographical situation, and the above circumstances, augur favourably for Queensland cotton, while the results of the small amount of our actual experience are in striking confirmation. Wherever cotton has been tried upon the coast in Queensland, without a single exception, it has surpassed all expectations. The yield has been plentiful, and the quality excellent. Notwithstanding our previous theoretical doubts, we cannot but be convinced that the capability of Queensland to grow extensively cotton of the most valuable quality is placed beyond all cavil. Whether its cultivation on a large scale would be remunerative, or as remunerative as the crops our farmers now mainly depend upon, is a question the following considerations seem to answer in the affirmative.

The crops now grown are very limited in variety. They could hardly be more so. Maize, English and sweet potatoes, oaten hay, make up the list. Arrowroot has been manufactured, and a superior article, but the quantity hitherto produced has been too small to be worth speaking of as a crop. The sweet potatoe, though yielding a large weight of return, has the serious defect of keeping sound but a short time after being dug up; and this prevents its cultivation on farms any distance from market. It is upon the sale of maize and English potatoes, grown alternately upon the same land, our farmers principally rely. The average yield of English potatoes is not more than two tons per acre; their average value may be stated at £10 per ton. Maize yields on an average of forty bushels per acre, while its value hitherto may be averaged at five shillings per bushel. These averages of value, it may be observed, are based upon a scale of prices higher than will probably be maintained. Maize can be grown on the banks of the Manning and Clarence rivers, but a short distance from Brisbane, by a cheap coastwise communication, and can be sold for less than five shillings per bushel.

Two tons of English potatoes at £10 per ton, and forty bushels of maize at five shillings per bushel, amount to £30 per acre. This is a larger amount than is generally realised. It is quite possible to grow the two crops on the same land within the twelve months, but our farmers do not regularly accomplish it, as it requires an unintermitting and heavy application of labour, with very favourable weather. English potatoes are but a precarious crop, being often a total failure. Though the quantity produced of either potatoes or maize has never been large, our farmers sometimes find great difficulty in effecting sales.

The perennial nature of the cotton plant in Queensland would much lessen the labour of its cultivation, which, not to speak just now of picking, would consist in keeping the land clean, and in pruning the trees. The pruning would be easily accomplished, and a horse-hoe would perhaps most cheaply keep the weeds under; they would, indeed, be considerably checked in their growth by the shade of the cotton trees, even when comparatively young. Five acres have been assumed, because this breadth of land appears not more than many would be inclined to plant; it could be appropriated to cotton on any farm without risk or anxiety, should an unfavourable season interfere with a successful result. Five acres would be space enough for 4500 trees, supposing them planted six feet apart with eight feet between the rows. A yield of two pounds per tree would be 9000 lbs. of cotton in the seed. Deducting two-thirds for weight of seed, there remain 3000 lbs. of clean cotton as the produce of the five acres. Now as to the value. Samples of Queensland cotton have been valued in Manchester at from 2s. to 4s. per lb. An account sale of two bales of cotton in the seed sent from Brisbane in the Gladiolus is very satisfactory. One of the bales contained all the stained, inferior cotton that was lying about when the other bale had been made up. This, with all its defects, sold for tenpence per lb., and there was in it cotton worth from fifteenpence to eighteenpence if it had been classed. The bale of white cotton brought one shilling and ninepence per lb., and this bale had a quantity in

it valued at two shillings per lb., but being mixed, the best sold for the price of the inferior. Speaking of samples of Queensland cotton sent in 1856, Mr. Clegg, of Manchester, writes in a letter which is given in full at the close of this paper, "to show that there is no risk, I dare at this moment buy 500 bales of from 300 to 500 lbs. each of this cotton at two shillings per lb." That is to say, that he, as an individual only, would purchase £20,000 worth. He says again, alluding to the Queensland growers, "Do not, however, let them deceive themselves, but calculate, as one of themselves lately said, on realising an average of fifteenpence to eighteenpence per lb." But supposing the grower could sell in Queensland for tenpence per pound, the value of 3000 lbs. would be £125. With this income from five acres, with regularity and certainty every year, few of our farmers would complain.

Maize and English potatoes have been spoken of as being of a perishable nature even when gathered in; cotton may be said to be, in comparison, imperishable. They are again, sometimes difficult to sell, and prices vary considerably. Cotton has, on the contrary, a sure and instantly realisable cash value, which is liable to but slight and unimportant fluctuations. A farmer of known steadiness and integrity, would easily obtain an advance upon his cotton crop, while being picked, or while yet growing; to ask similar assistance upon the security of either maize or English potatoes would be regarded with suspicion, nor would such a request be generally granted. Upon cotton as a security, it would be quite a legitimate transaction: equally so, indeed, as upon that usual security, a lien of wool upon the sheep's back.

The difficulty most apparently formidable connected with a large cotton cultivation, is the picking; but there is no reason at all to conclude that it is insurmountable. As an annual operation, requiring for a time a concentration of labour, it much resembles shearing. Who would suppose, that with labour scarce and expensive, our squatters would so easily effect the shearing of their 20,000, 30,000, 40,000, and 50,000 sheep? They do manage it, and always have managed it, even in the worst of times. If ever the wool has remained on the sheep, the reason has been that the price of wool was too low to make it worth while cutting it off. From analogy, therefore, it may be inferred, that if there is cotton to be picked, it will be picked, especially as in this, the labour of women and children can be turned to account. It is not easy to put the labour of picking into the form of a calculation in figures. But in the United States 200 lbs. per day is considered an average day's picking for one person; now the crop we have mentioned of 9000 lbs. of cotton in the seed would be gathered in 45 days, or in less than half the time the picking season continues, by a man, a woman, and a boy, supposing that they amongst them picked 200 lbs. per day.

Looking at the cultivation of cotton as affecting other colonial interests, it should not be lost sight of that the land on which cotton would be grown, is the land which is not used for pastoral purposes; or at least, the land which is least valuable and not selected by preference for pastoral purposes. It would not be so much land withdrawn from pastoral occupation, but so much land now liberally contributing to the opulence and stability of the colony, previously almost entirely valueless and unproductive. Carriage is an expensive item with wool, it would not be so, in an equal degree, with cotton. Coastwise, the conveyance of cotton to the central depot would be more readily and economically accomplished than that of wool per bullock-team from even the Darling Downs to Brisbane.

When, a few years ago, some cotton was planted, and public attention was being directed to it as a probable export, there were difficulties in the way which do not now exist. The want of a good cotton gin was then a serious inconvenience, which perhaps more than any other cause, discouraged the efforts then made, and which, under other and more favourable circumstances, would very likely have been continued. The Manchester Cotton Supply Association have forwarded some cotton-gins to Australia, and there are now in Brisbane, three or four of Dunlop's manufacture, belonging to a firm who have steam-power to apply to the working of them, and who are prepared to clean and ship on growers' account, and who would probably purchase any cotton in the seed offered. These gins have reduced very much the expense of cleaning the sea-island cotton, and our having several on the spot has removed a great obstacle.

At Maryborough, a seaport town about 150 miles north of Brisbane, a Joint Stock Company for the cultivation of cotton has been formed, and proceedings have been commenced with vigorous enterprise. Every one must wish them success, but the past history of colonial agricultural companies is not encouraging. There are so many difficulties, some only of which can be foreseen and partially provided against, that we are unable to coincide with those who look for the establishment of a cotton export from any joint stock company. Our plan is altogether different. We would have cotton grown as one of several other products by individual efforts on convenient sized farms, each the actual property of its cultivator. In other words, we advocate the formation of a class of agricultural freeholders. But our reasons for thus thinking will be more appropriately embodied in the following and last division.

3. In the preceding division of our subject, a point of considerable importance was but just referred to, and we now propose to develope it more

fully, bearing as it does with much weight upon the most interesting and momentous question, "The speedy and adequate colonization of Queensland." By the term colonization is here meant the settling down in peace and plenty as large a number of our own countrymen as our spacious, salubrious, and magnificent territory will permit. There are still persons to be found who would fain persuade us that Queensland is fully colonized, when there is an abundant supply of shepherds to tend their flocks. It is in perfect harmony with the nature of things mutually similar, that this essentially narrow and selfish idea should be found in amicable fellowship with another one, equally disreputable, viz., that in Queensland, agriculture will not pay. What a libel on the fertility of our soil, and the healthfulness of our climate! Truly, the advancement of propositions so monstrous, clearly shews how personal interest can disturb and enfeeble an otherwise vigorous mental perception.

No one, in his heart, can question that it is the intention of Providence that every serviceable part of the globe should be the dwelling of man. Transferred to Queensland, both capital and labour would be help-mates, not rivals, and would both be most amply rewarded. Our great primary want is population. We require a number of people, a flow of persons, old and young, rich and poor; an even, continuous, influx of human beings to our colony; in short, a diversion of the stream of emigration flowing from the United Kingdom to the United States, to Queensland. It is hoped that none will understand the above remarks to include in any form even a secret wish for the labour of a degraded and opposite race of coolies. We may welcome the capitalist, but common sense should lead us to accord a welcome equally hearty to the labouring man and his family, without whose co-operation the mere capitalist is utterly powerless. Labour does produce capital, it is the creator of capital, but mere capital can produce nothing. It is sometimes said that we do not want emigrants who have only their health and strength, so much as we want moneyed men. This is not true, and never will be true. Give us the men, women and children, and capital will soon follow, if not actually accompany them.

The unparalleled rapidity of the progress of the United States is not attributable to the settlement there of rich men, or even of men of moderate means. On the contrary, it is unquestionably owing to the immigration of poor people, who had no alternative but to cut down the forest, hold themselves the plough, and compel from the land a livelihood. The progress of Australia is in distressing contrast. Australia seems to have been selected as the licensed ground on which any theorist could play his silly game. The result has been that the Australian colonies have just crawled along, while the United States have positively leaped into high national estimate and dignity. Sydney, Adelaide, Melbourne, are names which represent the colonies of which they are the metropolitan cities, in a more injuriously comprehensive sense that does London for England, or New York for the United States. What has made this difference in the United States? This one fact: that from the beginning of their history, agriculture has never been degraded from her true position as the basis of every other national interest. Every facility has been offered. Land has been cheap, no squatting monopolies were allowed even to draw a first breath, land has been readily and cheaply procurable, and as a natural and harmonious consequence, while Canada was standing still, and while New South Wales was and is standing still, great and almost unmanageable masses of human beings have shoaled over to where they were intelligently appreciated, have spread themselves silently all over the land as freeholders and have made the country which adopted this generous and wise policy, a country of wine and oil, of superabundant plenty; among the nations of the earth, the infant Hercules.

If we really desire our colony to press forward in the race of progress, we shall be prepared to give every assistance to the rise of an agricultural interest in Queensland. The most immediately practical and pacific method we can adopt is by the cultivation of cotton, grown, as before observed, mostly on the coast; the bale of wool will not have to look with jealousy upon the bale of cotton. There need be no jostling or animosity of any kind. Grown by a numerous class of proprietors of small farms, of not more than 100 acres each, the labour performed by themselves and their families, cotton would be produced more cheaply and permanently than under any other system. It is perhaps open to discussion whether the Government, besides throwing open land suitable for the purpose at five shillings per acre, and plenty of it, might not assist the cotton growing interest in its infancy by offering a premium upon every bale grown for the first and second years. It is not that the commercial interests of the colony would thus receive a magical impulse, but that our social and political interests would be established on broad and enduring foundations, by the creation of that middle class Australia has never seemed to care much about, but the non-existence of which is now justly deplored as a grave and pregnant evil. The heated feverishness which is chronic amongst a gold-digging country, we should be happily free from. Moderate, reasonable expectations, to be realised from steady, persevering industry, would characterise the great bulk of our population. In such a state of things, we may hope for progress in matters of higher importance than any considerations of mere political economy. Religiousness, public spirit and virtue, the arts and sciences, would

find here, in Queensland, a congenial atmosphere, a happy home. If this inspiring prospect were brought nearer by its efforts, the Philosophical Society of Brisbane would have accomplished no trivial end, nor could it be said, even supposing little else accomplished, that it had been instituted in vain.

COPY OF MR. CLEGG'S LETTER.

"28, Corporation-street, Manchester,
"January 3rd, 1857.

"GENTLEMEN,—It gives me pleasure to state, after consulting Mr. Bazley, Messrs. Houldsworth, Barnes & Co., and a dealer in sea-island cotton, that the sample you sent to me is of very superior quality, almost too good for ordinary fine yarns and for practical purposes. It was variously valued at from two shillings to even four shillings per pound for fancy articles; the prevailing opinion being that it would realise two shillings and sixpence to three shillings per pound, which I believe it would for moderate quantities, but great quanties of such valuable sorts are not required, being of limited consumption. I think, however, they might fairly calculate upon two shillings per pound for a long time to come for such cotton. I have no doubt, that where this was grown, they can produce *in quantity*, the best cotton in the world perhaps, and ought forthwith to turn their attention to it, by getting abundance of labour, either from China or from other sources, free from any risk of introducing slavery in its cultivation.

"Your friends are right in saying that great care will be required in cleaning the cotton, so as *not to damage its colour, or injure the staple.* For this purpose none but the roller gin should be used, unless perhaps M'Cartney's, which might also be tried, and both are made in Manchester at Messrs. Dunlop's; I can get them right for your friends' experiments if they wish. This fine cotton would, however, pay to be picked, sorted, and cleaned even by hand, although slow work.

"The seed should be *dry and hard* before being cleaned, otherwise it crushes instead of leaving the cotton freely, and the *oil* in the seed stains the cotton. The finest and best grown pods should always be kept together, the next ditto; and even a third quality of inferior ones: by these means the best prices would be realised for each, whereas if mixed altogether, the whole would only sell for what the inferior alone would fetch.

"A gentleman who has a son in Australia, has previously sent me samples of this cotton, and they cannot do better than begin to plant all in their power, and send it in quantity. I shall have great pleasure in selling such as they may send, to enable them to get the best possible price for it. To show that there is no risk, I dare at this moment buy five hundred bales, of from three hundred to five hundred pounds each, of this, at two shillings per pound. Do not, however, let them deceive themselves, but calculate, as one of themselves lately said, on realising an average of fifteenpence to eighteenpence per pound. Even this would be a very high price, Indian cotton ranging from 3d. to 5d; American Bowed Uplands Orleans, 3½d. to 8½d.; Brazil, and similar staple, 5d. to 8d.; Egyptian, from 5½d. to 10d.; and sea-island (your variety) 11d. to two shillings, fine quality to four shillings per pound.

"Yours very truly,
"THOMAS CLEGG.

"Messrs. Robert Barbour and Brothers,
"Manchester.

"P.S.—Please get me larger samples."

W. C. BELBRIDGE, PRINTER, BRISBANE.

LANDSCAPE DESIGNING.

A PAPER READ BEFORE THE PHILOSOPHICAL SOCIETY OF QUEENSLAND, ON THURSDAY, THE 7TH AUGUST, BY MR. WALTER HILL.

THE term Landscape Designing has been adopted to distinguish a profession, the principles of which, though volumes have been written about it, are not fully understood. The purpose of the profession is to assist those who have little or no taste themselves, in so arranging plantations and shrubberies, conducting roads of approach, forming rides and walks, placing buildings, &c., as to satisfy the taste of others who may have any in such things. This definition, homely as it may appear, is in reality the marrow of the matter, and at once declares that those who may adopt the profession must have the taste required to such a degree as to induce confidence to be placed in them. Then comes the question—who is to judge of the qualifications of a landscape designer? Of course persons who have, at least, as much taste as the professor. Hence, were a gentleman admitting himself not to have sufficient taste of his own to enable him to dispense with the help of a landscape designer, to require it, it may be asked—to whom should he apply for guidance? To a skilful professor. It is common, in requiring the character of a servant, to apply to the master whom he last served. It is evident, however, that in the case of a landscape designer, we should not apply for information to the employer, because he has, by the very act of employment, declared himself unfit to give any opinion. If the gentleman be requested to judge for himself by looking at what has been accomplished, this is absurd: because he has confessed himself to have no knowledge of such matters, no taste; and consequently to be unable to judge of any such work. There is considerable difficulty to be overcome in any attempt to teach landscape designing as an art; because it is scarcely a thing to be taught in the common acceptation of the term, but rather a thing to be sought for and brought out. There must be an inward impulse in the pupil; a quick perception of form, colour, and relative position; of magnitude, and of the harmony of things in general; and all this is no less necessary in the teacher. Besides, according to my idea, landscape designing is not a thing to be taught, even to those possessing the necessary talent, without a direct appeal to Nature. A certain amount of materials is given to be worked upon, and the question is, how to make the most of it? But unless the materials be present to our senses, it is impossible to point out the various means by which they may be made available to the utmost extent.

We have the dead flat, the undulating surface, the hilly, the mountainous, and the rocky country, and endless mixtures and modifications of these, and land and water. We have not merely one window to look from, but many, having various aspects, and innumerable points of view out of doors, to consider.

The matter which requires the greatest skill is to contrive to make one thing serve many purposes—one tree or bush to fall in with advantage to many points of view. I have seen (according to my own notions) very good artificial landscapes made out of indifferent subjects, and tolerable subjects made hideous by attempt at embellishment. I have seen admirable subjects spoiled, others rendered splendid. Though I have had to deal with some of the best subjects in Nature, and found my work admired, (whether the admiration was real or false, matters not), I am not so conceited, or so ignorant of the constitution of human nature, as to set my taste up as a standard. I have often had to revise my own work, and to make corrections and additions; and some painful necessity has occurred to me in my time, such as that of felling a fine tree, because, though, while young, it performed an important part, it had grown too large for its station in the landscape.

I have said enough, perhaps, to show that what is called landscape designing cannot be taught in the closet; and, though rules have been laid down on paper, that they cannot be applied with any degree of certainty. I do not affirm that the profession is not needed; it is a useful one, provided he that practises the art has a love for it. It re-

quires more various talent than almost any other profession; and were we to appeal to a phrenologist, he would probably enumerate more than half-a-dozen faculties which would have to be in a state of strength and activity. A young person inclined to follow the professsion should be taken to see Nature in all her aspects, and from her he should take all his lessons, for this reason, that the Creator has adapted Nature to make agreeable impressions on our faculties, as well as to excite some emotions which warn us of danger, and others which arouse wonder, fear, and gratitude to their Author. He should draw well, so as to be able to accumulate examples, which he may transfer, as his judgment may direct, to any portion of country he may be called upon to adorn. It is a duty to the public to be performed by every proprietor, for rendering a district agreeable to the eye, to look out for some one who does possess it, and whose assistance he should require.

When we consider the infinite variety of objects presented to the eye in all the varied scenery to be found on the earth, it becomes clear that man must be endowed with faculties enabling him to derive pleasure from contemplating them. It is not enough that man should perceive there are things present external to himself, he must have power to distinguish one thing from another. Seeing the necessity of this, it is proper to consider what these powers are, before we think of their exercise in the profession I am attempting to illustrate. This is rather an extensive range of subject, but I shall be brief, studying merely to give useful hints, and leaving those who may feel desirous of deeper research, to satisfy themselves by applying to special sources of information. After the perception of the presence of an object, its occupation of space perhaps, we regard the secondary one to be its magnitude in comparison to our own dimensions, or those of other objects. We have, therefore, a faculty to perceive magnitude or size, and a faculty to compare one magnitude with another. The next perception may be that of the boundaries or outline of the object, that is its form or shape. Here I speak merely as if the objects were flat. When an object is not flat, but a solid, we are enabled to discover the entire form by the assistance of light and its degrees of shade. Though shade be essentially shadow, it is a useful stipulated term to distinguish when it relates to the part of form which it brings out to the eye; while shadow is employed to denote the effect of interruption of light by an entire mass of matter independently of every part of its form except the outline. The ascertainment of form by the sense of touch we need not consider, for landscape designing has to do only with perceptions excited through the eye. We have then a mental faculty enabling us to distinguish forms which are of endless variety, made up of lines and surfaces, straight and curved. Outline depends on form, and therefore, when agreeable outline is required in a landscape, selection is to be made of objects having forms suited to produce it.

But, it must be observed, care should be taken in selecting forms for an outline, that they are in other respects suitable to the position in which they are to be placed, and not disagreeable in themselves individually. Hence this faculty of form must be possessed in a high degree by the landscape designer, so that this perception may be quick in regard to the supply of what may be wanting, and to the removal of what is unsuitable. There is, besides, a perception of harmony required, of suitableness, of fitness, independent of simple form, that which may be pleasing, and that which may be offensive. Indeed, in this consists the chief power of a landscape designer, who is fitted by nature to follow the profession. But it is probable that the perception of harmony may belong to the faculty of form. It may be a faculty independent of it, but it is claimed by others also, and on that account seems to be in connexion or even an integral part of each. It is obviously necessary to the landscape designer to have an acute perception of the relative position of objects. This is undoubtedly a special faculty, and to it belongs the memory we have for places and the power for finding our way. In grouping, objects may be placed beyond all means of amendment in relation to each other, however agreeable their form may be individually. If we feel pleased with one mode of grouping a certain number of objects, and displeased with another mode, it is obvious we possess a particular faculty different from simple comparison, one which enables us to derive satisfaction of a distinct kind from the perception of a particular arrangement. The next faculty which ought to be found in the mind of a landscape designer is that of imitation. We all know how readily this faculty runs into abuse when powerful, and not restrained by a sense of propriety. The proper exercise of it, in the case before us, is to imitate Nature. To ask in all cases, what would Nature do?

To be able to answer that question the landscape designer is supposed to have followed the advice formerly given, to examine Nature in all her aspects, and to take heedful note of them. A clever man in looking at a scene to be improved, can form in his mind almost in an instant a view of what is required. He can see at once what the execution of his design will effect, if well carried out. Having made himself acquainted with every kind of tree and shrub that may be available, its habits, size, colour, style of growth, &c., &c., he knows what to select, and what will suit the soil and climate. The knowledge he must acquire, in order to enable to imitate Nature, to make Art her handmaid, is extensive. The imitative power is indispensable; but there must be also a discriminative power to hinder it from misplacing imitations. The faculty I next briefly

consider, that of construction, ought evidently to operate in a landscape designer, though the practitioner has only to design: but in designing, the execution of the design is kept in view, else schemes might be propounded, the realising of which might be impossible. It appears to make clear the conception of how a thing may be done, and likewise how it ought to be done, when more ways than one of doing present themselves. It is intimately connected with what is called intervention, and may possibly be identical with it. For everything is constructed in the mind before the hand is set to execute. With a few observations on colour, and remarks on one or two collateral subjects, I shall conclude what I have to say. Besides the power of vision, properly so called, and which makes us aware of the presence of objects, there exists a particular faculty which takes a judicial notice of colour. I have known persons, who, not possessing this faculty in a sufficient degree, mistook one colour for another, and could not distinguish them. Some persons, again, have so strong a passion for colour, as to delight in its contemplation, without any regard to harmony or fitness, The landscape designer must possess this faculty in a proper degree: he must have not only a quick perception of mere colour, but of harmonious arrangement, and the effect of shade, and of one colour upon another. The vegetable world presents every variety of colour, but the landscape designer has to do with but a small number, and chiefly with varieties of green, and the varying hues of spring and autumn. Nor is this all; he must be acquainted with the season at which each tree or shrub shoots forth and sheds its leaves. This requires not a little study. Then comes the selection of shades of foilage and styles of growth adapted to various situations and special scenery. Nature tells us not only in what situations certain trees will live and grow, but she has genera and species for every climate, so that few positions suited to the dwelling of man are without something that is gratifying to the eye; and where there is deficiency, it is in his power to supply it. Man was not created to be idle, and every inducement has been held out to him for exercising the powers with which he has been endowed. The wildest wastes of Australia are capable of improvement, and the only obstacle to its being effected is to be found in the want of means. Wealth is necessary to reclothe the surface; but alas, where wealth should most abound, there does poverty extend the farthest. Were riches expended in the improvement and embellishments of land, instead of being scattered abroad as they too frequently are in useless and unsatisfactory luxury, sufficiency might be enjoyed by all. The variety of green tints is very great, and their disposition of importance. Green is a mixture of blue and yellow, and the prevalance of either must be studied. Evergreens should generally be so disposed as to form a mass when other trees are naked. Single pines, firs, bamboos, and palms, if room be given them, produce a fine effect.

When a house is to be built where trees already abound, difficulties will occur in choosing a situation. It is dangerous to cut down trees before the building has been erected, and yet effect may not be brought out so as to assist in the choice without thinning. It is difficult to conduct roads where trees stand thickly; in such a case the landscape designer should proceed with great caution, removing first such trees as are not in themselves worthy of a place. Of all things connected with landscape designing buildings are often most offensive; and we find the grossest defect of taste frequently displayed both in their style and position; many persons are apt to associate external nature with the state of society in times long past. This is an error that has led to many trespasses against nature's rules. A man will build a castle, because the situation he fixed for it is a commanding one. His taste leads him into expense, and to the sacrifice of convenience and comfort. Dwelling-houses should be arranged for comfort, and where means are at command; also for elegance and grandeur, both internally and externally. The ruins of ancient buildings produce a most pleasing effect; and they ought to be preserved. But it would be preposterous in our day to build that which is felt to be impressive only when in a state of ruins. This is a subject not altogether separated from landscape designing, when a professor finds buildings in his way, it is his business either to hide or to exhibit them to the best advantage.

W. C. BELBRIDGE, PRINTER, BRISBANE.

LECTURE

ON

CLIMATE.

(From the *Moreton Bay Courier*, August 30, 1860.)

On Tuesday evening, an interesting lecture on "Climate" was delivered by Dr. Barton, at the School of Arts, before a numerous and attentive audience. The importance attaching to the subject, and the valuable information the lecture contains, both warrant us in publishing it in its entirety, and we do so with the more pleasure because we know that Dr. Barton bestowed no small amount of care, thought, and attention upon his subject.

In the following observations on climate, I have made free use of all trustworthy authorities on the subject, for I would say with Dr. Johnson—"If no use be made of the labours of past ages, the world must remain always in the infancy of knowledge." Although I agree with the paraphrase of the words of Lord Bacon, that "the lecturer must not be the ant, collecting all things indiscriminately from all quarters, as provender for his discourses; nor the spider, seeking no materials abroad, but spinning his web of speculative doctrine from within himself; but rather the bee, extracting crude honey from various flowers, storing it up in the recesses of his brain, and submitting it to the operation of his internal faculties, until it be matured and ready for use;" yet the subject being large and difficult, I must claim little of originality in my remarks.

By climate I mean, the prevailing state of the atmosphere of any region, with respect to heat, cold, moisture, winds, and impregnation with electricity, and ozone. The consideration of this subject—the atmosphere which we breathe, and in which, and by which, we live—should be interesting to all.

It would be very pleasant and profitable to dwell somewhat upon the moral effects of climate; to trace traits of national character or disposition, examples of great achievements of learning, or valour, or peculiarities of physical conformation, to the climate and neighbourhood in which they have been noticed; for we know that man, unlike animals, can exist in almost any clime of the globe,—under the burning sunshine of the tropics, and amid the perpetual and profound frost of the polar regions; and that these different degrees of external temperature impress peculiar physical characters upon those who are subject to them. Towards the poles man becomes stunted, both in mind and body. The ordinary stature of the Samoydes, we read, seldom exceeds four or five feet, and their whole exterior corresponds with their dwarfish size. On the other hand, we know that all the functions of the body are developed and ripened faster, under the stimulus of the sun, as we approach the equator; though we must remember that considerable heat acting for a long time together, has an exhausting or depressing effect upon the animal functions—the nervous system—causing languor and lassitude, want of energy, and a disinclination to exertion, both bodily and mental.

A temperate clime, no doubt, is that most congenial to high mental attainments, and indeed to the most perfect development of the species: though the position of the country geographically has less to do—as I shall show when speaking of isothermal lines—with the climate, than has elevation of position, or proximity of mountains, &c. But this part of the subject, not being that to which particular attention need now be directed, is passed over, and I come to the

matter of climate itself. I have already given a definition of the term climate; we have first to notice the atmosphere itself, and in connection with its changes, the instruments used to obtain the valuable results of such information. Atmospheric air, as viewed by the chemist, is a mixture (not a chemical compound) of 21 parts by measure of oxygen, 79 of nitrogen (or azote), and a trace of carbonic acid. But to the meteorologist it is the gaseous ocean under which we live, and to whose waves those of the most tempestuous sea are, by comparison, calm and insignificant. The ancients had long observed that space was filled by some material substance, and that on the removal of a body, air rushed in and filled the space; hence the dogma that "nature abhors a vacuum;" but it was reserved for Torricelli, in the middle of the seventeenth century, to demonstrate the weight and pressure of air. He had noticed that in the pump a column of water was sustained of 32 feet, and argued, if a body heavier than water were used a column proportionately lower could only be sustained by the same power. To prove this, he took the heaviest fluid he could get—mercury—and placing it in a long tube, closed at one end, placed his finger over the other end to prevent its escape, and plunged this open end into a vessel also containing mercury; on removing his finger, he found the mercury fell, until, balanced by the pressure of the air, it stood, not like the column of water at 32 feet, but at a height at 30 inches: and by this beautiful and simple experiment he invented the barometer. This, like most discoveries of value, was rejected by the scientific men of the day, who still adhered to the dogma, that "nature abhors a vacuum;" at last came the final proof; if said one, the suspension of the column of mercury, be due to the weight of the air, let us ascend a mountain with this instrument, and as we leave air behind us, there must be less above us, and this diminished weight of air ought to press less, and sustain a lower column of mercury. This at once was done, and as they toiled up Torricelli with delight beheld, as at each halting place they made a new observation, the column, standing lower and lower, and the truth of his new doctrine established for ever. Indeed, from that time—the proportion having once been ascertained—mountains and all accessible elevations have been measured, by noting the difference at which the column of mercury of the barometer stands at the base and at the summit. To determine, then, the weight, and to ascertain the pressure of the air, the barometer is an instrument of the highest importance, and as changes in these points correspond closely with changes in the weather, an indispensable one in assisting to determine the climate of a place. It is apart from my purpose to go minutely into a description of these changes, for the principle on which the barometer acts being well understood, a few plain rules and careful observation are the proper teachers. To determine the temperature of the air and of evaporation, the temperature of the dew point, the elastic force of vapour, the weight of vapour in a cubic foot of air, the additional weight required to saturate a cubic foot of air, and the degree of humidity, an instrument, the wet and dry bulb thermometer, is used. It is very simple in construction, and easily managed, and unlike Daniel's hygrometer, without expense. The wet and dry bulb thermometer is simply two ordinary thermometers, with small bulbs and very small bores, fixed side by side on a frame. The wet bulb being covered with a piece of thin muslin, some cotton passes from the bulb to a bottle of water fixed below it. The readings of the two being taken, the results above mentioned are obtained by calculations or from tables prepared for the purpose. But this simple little instrument, besides the above data, gives—as well remarked by Mr. Glaisher, the Secretary of the British Meteorological Society—useful information in many cases in ordinary life, and might very generally be used with advantage. The simple inspection of the two thermometers will often afford a better criterion of the weather, and the probability of rain, than the barometer itself; thus in summer, if the temperature of the air increase, and that of the dew point decrease, it is an indication of very fine weather; on the contrary, if the temperature of *both* increase with the day in nearly equal proportion, rain will almost certainly follow, as the temperature of the air falls with the declining sun. Again, its importance to the requirements of a sick chamber are scarcely to be over-rated, as the comfort of the patient is often dependent, not so much on the temperature as on the hygrometric condition of the air; a difference of from six to eight degrees, between the reading of the two thermometers, will generally be found to give a pleasant degree of humidity; if the air be too dry, it will be necessary to expose water, in some shallow vessel, of some extent of surface, so that the evaporation arising from it, mixing with the air, shall create a greater degree of humidity; if on the contrary the air should be too moist, the required dryness may be obtained, either by raising the temperature, or by placing in the room sulphuric acid, or any other medium which has the property of rapidly absorbing all watery vapour. For the same reason—the securing a healthy degree of humidity of the air,—this little instrument may render most essential service in the hot-house, green-house, and conservatory, and its careful use would result in the preservation of rare and valuable plants.

In the consideration of this subject of climate, a most important point is that of the rainfall, and along with this, as intimately connected with it, the formation of clouds, deposit of dew, amount of evaporation, and prevailing winds. "When (says Lardner) condensation of vapour takes place in the upper strata of the atmosphere, a

fog, or mist, is first produced, after which, the aqueous particles coalescing, form themselves, in virtue of the attraction of cohesion, into spherules, and fall by their gravity to the earth, producing the phenomenon of rain." This account, however, is a meagre one, for the reason and manner of the condensation is not explained; I prefer, therefore, Dr. Hutton's description. According to this, rain depends on the great principle "that the quantity of moisture which air can hold, increases in a much faster ratio than its temperature;" for if we have two equal bulks of air saturated with moisture, and of the different temperatures of 15 deg., and 45 deg., driven together and mixed, the resulting temperature would evidently be 30 deg., now the air at 15 deg. can contain 200 parts of moisture, and that at 45 deg. 800: the aggregate being 1000, or either half 500; at a temperature of 30 deg., however, this portion is only able to contain 400 parts of moisture, the remaining 100 parts being precipitated, forming clouds or descending in rain; on this principle then, modified by previous dampness, and the fact of complete or incomplete mixture, depends the formation of clouds and rain: it will therefore be readily understood, how in warm weather, with variable wind and squalls, large quantities of rain should be precipitated by the violent mixture of clouds of unequal temperature; while a continuance of steady wind is accompanied by dry weather. Clouds then, as we have just seen, are minute particles of water, condensed from vapour by a lower temperature, and which from their minuteness float like fine dust in the air; fogs are clouds resting on water, and clouds fogs, suspended in the air. But besides the ordinary rain fall, we have frequently during the night, and often in considerable quantity, the deposit of an insensible rain called dew: this being dissipated by the evaporation, which is always going on, especially in the warmth of the sun. Thus we have a beautiful accord and harmony, on the one hand, vapour rising up in fogs and clouds from the surface of oceans and rivers, wafted on the land, and descending upon the earth to be again returned to the rivers and seas; whilst upon a smaller scale, and in the silence of night, we notice the dew descending, and partly compensating for the evaporation of the day. Now as it is interesting to know the exact proportion between, and quantity of, the evaporation and dew, I have had constructed, by a clever maker in Sydney, (A. Tornaghi,) a very simple apparatus, to measure the amount of evaporation: it is merely a cylinder containing water, having a metallic pointer, which can be raised or depressed by a screw above; the upper part of the pointer being provided with a scale, marked to inches and tenths, and vernier, exactly like the barometer, but read downwards; the cylinder being almost filled with water, the pointer is depressed, until its fine extremity touches the surface of the water; the scale is then read: at any subsequent time the pointer is again depressed to the surface of the water, and the difference, as read on the scale, gives the amount of evaporation in the time between the two readings; any rain that may have fallen being added to the result; but I found, that though this little instrument worked perfectly well, yet the result could not be correct, as the heavy dew which fell, fell in the cylinder, as on all around, and ought to be, like rain, added to the quantity of evaporation. To obtain absolute correctness then, I have had a small dew guage constructed, by which the quantity of dew deposited can be readily determined, and added to the second reading of the evaporator; by these means I find the evaporation of forty days and nights to be 3 inches two-tenths; whilst the dew deposited during the same time has been three-tenths of an inch; the evaporation thus being two inches and nine-tenths in excess of the dew deposited.

The formation of hail and snow are wrapped in some obscurity: the hypothesis of Volta, respecting the formation of hail being somewhat probable, as well as ingenious, is here given: premising that hail is invariably seen with and during thunder and lightning, and is therefore the effect of sudden electrical changes in clouds charged with vapour, Volta supposed that two clouds of different temperatures, the one charged with positive, the other with negative electricity, approached one another, until the one was vertical above the other; the difference of temperature having produced condensation in the upper cloud, with sufficient cold to produce ice, small hailstones are formed, and fall upon the lower cloud, but as in the well known experiment, where two elder pith balls suspended with silk, and charged with opposite kinds of electricity, repel each other, so the small hailstones are repelled by the oppositely charged lower cloud back to the upper cloud, their size somewhat increased by the congelation of additional vapour; arrived at the upper cloud, they acquire again additional size, and are thrown back to the lower cloud; and this is again and again repeated, until their weight becomes so great, that they resist the electric attraction, and fall by their gravity to the earth.

At a temperature of 32 deg. Fahrenheit water under ordinary circumstances freezes, or becomes ice; in a perfectly still place, however, the commencement of freezing is often delayed, until the water is somewhat below freezing, and on the other hand hoar frost is seen, with the thermometer several degrees above 32 deg.: as this last fact is an important one to gardeners and agriculturists, a short explanation is added, hoar frost (or frozen dew), when seen in a surrounding temperature above 32 deg., is occasioned by the power, which plants and various bodies have, of radiating heat; thus grass and plants generally are powerful radiators, stones and earth bad radiators, glass a good radiator: and thus we see hoar frost on the window panes, and on plants, while the bare earth is untouched; for these bodies when no longer under the influence

of the sun, radiate, or throw off, their heat, and soon sink below 32 deg. in a temperature several degrees above it; on these cold surfaces the dew descends, and is frozen, producing those needles and crystals of ice, with which we are familiar. It was said just now, that hoar frost was frozen dew; this however is not invariably true, for besides parting with their heat, plants throw out moisture from their own bodies which may become frozen, this is often the case with buds of trees in early spring, and blight ensues; the obvious plan to pursue where practicable, to save plants or flowers from frost, is to cover them over, which checks the power of radiation and protects their cold surface from the dew. I have now, as an important element in the matter of which I am treating, to speak of winds; and first for a definition, what is wind? and next to seek the cause—how are winds produced? Winds are sensible currents in the atmosphere, propagated either by compression or by rarefaction; developed directly in or inversely to the direction in which they blow, by the one or other condition of origin. The general causes are stated as follows:—1. The ascent of the air over certain tracts heated by the sun. 2. Evaporation causing an actual increase in the volume of the atmosphere. 3. Rain, snow, &c. causing an actual decrease in its volume by the destruction of the vapour. It is easy to understand that if a portion of water be removed from a reservoir, the surrounding water will flow in and restore the equilibrium; or if by force we impel some of this fluid in a certain direction, an equal quantity will move away in a contrary direction; and also if a portion of the fluid rarefied by heat or condensed by cold, ascends in the one instance, and in the other descends, a counter current being the natural and visible consequence, so with the invisible atmospheric air similar effects are found to follow the same causes. With this knowledge then, we view the wind, not as the "fickle breeze," but as the atmospheric ocean, obeying proved and well defined laws. The trade winds, and the land and sea breeze, particularly demand some attention; it has already been stated, that the largest quantity of rain precipitated, is in tropical countries, where there are heat, squalls, and variable winds: The sudden conversion then of large quantities of vapour into fluid, and its precipitation on the earth, as well as the rarification of other portions by the heat of the sun, and its ascent, cause a local vacuum, and the adjacent air rushes in to re-establish the equilibrium; as an illustration of the magnitude of this vacuum, Dr. Lardner instances a fall of intertropical rain, of an inch in depth, and extending over a hundred square leagues; and states, that the vapour from which such a quantity of rain would be produced by condensation, would, at a temperature only of 50 degrees, occupy a volume 100,000 times greater that that of the fluid; the extent of the vacuum being, a volume of 200 cubic miles, or a column whose base is a square mile, and height 200 miles. But the cold air rushing in from either pole, to fill this vacuum, would be due north, and south, whereas the trade winds are N.E., and S.E.; this easting is caused by the diurnal rotation of the earth, which is in a direction from W. to E.; the particles of air being as it were, left behind, and so acquiring an easterly direction. A description of the trade wind is so simply and well given by Lieut. Maury, an American, that I shall add it, merely stating first, that about the equator, and also at the edge of the tropics, the opposing winds meet, neutralize each other, and form calm regions, and called the Calm Belts of the Equator, of Cancer, and of Capricorn. Queensland is situated about the calm belt of Capricorn. And therefore without the influence of the regular trades. Maury says "From the parellel of about 30 degrees north and south, nearly to the equator, we have extending entirely around the earth, two zones of perpetual wind, viz., the zone of north-east trades, on this side, and of south-east on that; with slight interruptions they blow perpetually, and are as steady and as constant as the currents of the Mississipi River; always moving in the same direction, except when they are turned aside by a desert here and there, to blow as monsoons, or as land and sea breezes. As these two main currents of air, are constantly flowing from the poles towards the equator, we are safe in assuming, that the air which they keep in motion, must return by some channel to the place towards the poles, whence it came in order to supply the trades. If this were not so, these winds would soon exhaust the polar regions of atmosphere, and pile it up about the equator, and then cease to blow, for the want of air to make wind of. This return current, therefore, must be in the upper regions of the atmosphere, at least until it passes over those parallels, between which the trade winds are always blowing on the surface. The return current must also move in the direction opposite to that wind, the place of which it is intended to supply. These direct and counter-currents are also made to move in a sort of spiral or etoxodromic curve, turning to the west as they go from the poles to the equator, and in the opposite direction as they move from the equator towards the poles. This turning is caused by the rotation of the earth on its axis. The earth we know moves from west to east, now if we imagine a particle of atmosphere at the north pole, where it is at rest, to be put in motion in a straight line towards the equator, we can easily see how this particle of air, coming from the very axis of diurnal rotation, where it did not partake of the diurnal motion of the earth, would, in consequence of its *vis inertiæ*, find, as it travels south, the earth slipping from under it, as it were, and thus it would appear to be coming from the north-east, and going towards the south-west; in other words it would be a

north-east wind. On the other hand we can perceive how a like particle of atmosphere, that starts from the equator, to take the place of the other at the pole, would, as it travels north, in consequence of its *vis inertiæ*, be going towards the east faster than the earth, it would therefore appear to be blowing from the south-west, and going towards the north-east, and exactly in the opposite direction to the other. Writing south for north, the same takes place between the south pole and the equator. Such is the process which is actually going on in nature.

The sea breeze, so grateful to the residents of tropical climates, is an example of a wind caused by rarifaction, the earth, heated by the sun, rarifies its atmosphere, causing a partial vacuum, and the cold air from the ocean rushes in to fill this, causing the afternoon sea breeze.

The Aurora Australis must be mentioned with the few remarks I shall offer on atmospheric electricity; the Aurora Borealis of the northern hemisphere was formerly supposed to be occasioned by the refracted rays of the setting sun, from and upon mountains and fields of ice, and indeed to one on the spot it seemed a reasonable explanation; in this situation amongst the ice it was often a most glorious sight—a trembling rose-colored flame at north, making a broad path of light over miles of field ice to the ship's side of the beholder rapidly fading away, and then bursting forth with increased intensity of color—now down to the horizon, and then flaming up with lines and flashes of light almost to the zenith. The aurora is seen here at south, as at north in the other hemisphere, but in my experience of the two does not equal the borealis in beauty, though some writers have stated the southern polar light to be the most vivid and beautiful. The following short account of the aurora of September 2nd, 1859, which you will all remember I wrote at the time:—"After a clear hot day a brilliant polar light was seen, as on the night of the 29th August, it commenced at S. soon after sunset and continued vivid and beautiful until near midnight—very vivid at 10 p.m., when the moon set, lines of lighter light flashing up towards the zenith, the whole mass of red fading and increasing in color rapidly in different parts of the aurora. Stars could be seen faintly through the red, and from time to time flashes like lightning behind it—the whole like a burning mass at S., varying in position, colour and flashes in a wonderful manner: at times as intense as the red fire of the theatres, and then in a minute almost gone." At this time in Sydney the electrical currents became so disturbed that during the day messages could not be sent through the electric telegraph. Mr. Scott, the Astronomer, was applied to, to explain this, but, if I remember rightly, was not able to do so in a very satisfactory manner; but in the evening the Aurora, as with us, made its appearance. It is certain, therefore, that the appearances which attend this phenomenon are electrical, and as Dr. Lardner says, "Whatever be its physical cause, it is evident that the theatre of its action is the atmosphere; that the agent to which the development is due is electricity, influenced in some unascertained manner by terrestrial magnetism." In speaking of the formation of hail, mention was made of clouds charged with electricity of opposite kinds. The atmospheric ocean, more than forty miles in depth, and at the bottom of which we live, is charged with positive electricity, and is the theatre of stupendous electrical phenomena; the surface of the earth being charged with the opposite or negative electricity. It is a well known law of electricity that bodies charged with the same kind of electricity repel, while those charged with opposite kinds attract each other; and so it is, that when two clouds charged with opposite electricity approach so near that their electricity surpasses the resistance of the air, the fluids rush together, a flash with sound follows, and lightning and thunder are produced. Exactly the same thing occurs on a small scale when a spark escapes from the charged Leyden jar. All of you are doubtless aware of the experiments of Franklin, who drew electricity from the clouds with his kite, and which nearly cost the philosopher his life. Subsequently, by the same means, blades of fire many feet long have been drawn from clouds, and with a report as loud as that of a pistol. Allied to the electric spark—(and which is the last matter in the history of climate which I have to notice)—is a newly discovered substance called *ozone*, and which is now being diligently investigated, and is exciting much attention, from the probability that it will throw light upon the origin and history of diseases, and ultimately lead to improvement in the treatment of them. Ozone, so named by Professor Schonbien from the Greek "ozo"—I smell—is generated by the passage of a series of electric sparks through dry oxygen, or atmospheric air. This odourous air emits a peculiar and somewhat metallic odour; it assumes several properties not exhibited by pure oxygen, the most curious of which is the liberation of iodine from iodide of potassium. Schonbein considers ozone to be a volatile peroxide of hydrogen; Dr. Andrews, a modification of oxygen. Its presence in the air may be ascertained by slips of prepared paper, freely exposed to the air, the light being partially shut off; the papers are easily made, and are inexpensive, and as some persons might feel inclined to make regular ozonometrical observations, I will add two receipts—Professor Schonbein's and Dr. Breed's, of Washington. Schonbein's is—water 200, starch 10, iodide of potassium 1; strips of paper, half an inch by three inches, are soaked in this, and dried, being kept in a close dark vessel for use. Breed's receipt is—starch 10, iodide of potassium 20, water 400 parts; the papers are freely exposed to the air each day, and, when removed, compared with a scale of co-

lours, and the result registered; Schonbein's papers being first dipped in water.

I have for some months registered the daily amount of ozone in the air here, using Dr. Moffat's papers and scale of colors; his papers have to be breathed on before being compared with the scale. I am not aware of Dr. Moffat's receipt, but the papers and scale can be procured at a small cost from Flavelle and Co., Sydney. Similar and regular registrations of the amount of ozone in the air, are being made in Sydney and Melbourne, as well as in towns of England and America, and which will, it is hoped, produce useful results.

The effect of the presence of ozone in the air on health is variously stated by writers. Mr. Scott, the astronomer, Sydney, considers its presence as a healthy symptom, as it combines with and neutralises injurious gases, and many others are of his opinion. On the other hand, Maury says, "Diseases are thought to be more or less prevalent, according to the abundance of ozone in the air;" and M. Wolfe, of Berne, "attributes many diseases to the effects of atmospheric ozone, * * * a remarkable correspondence between the variation in the quantity of ozone in the atmosphere and the change in the intensity of an epidemic dysentery, was noticed." With this uncertainty then of its effects, increased information and patient registration are required, and may produce most important results.

I have now to consider the climate of this country, more particularly this colony, and principally this place.

Humboldt divided the hemispheres each into six spaces or belts, from the knowledge that their temperature was nearly similar; the lines in the direction of, but not generally parallel to the equator, he called isothermal lines, and the spaces between them, isothermal belts or zones. Thus in the northern hemisphere, London, New York, and Pekin are on the same—the fourth—isothermal line, their mean temperature approximating, though their climate and vegetable productions are very different. In the southern hemisphere, Queensland is in the second isothermal belt, which has a mean temperature of 68 to 77 deg. The Cape of Good Hope, and Chili are in the same space. In the corresponding belt in the northern hemisphere are Funchal, in the island of Madeira, and Algiers, on the Mediterranean coast of Africa. The following results of temperature have been noted at these places.

Mean temperature of	*Funchal.*	*Algiers.*
warmest month	75·5	82·8
coldest month	64·0	60·1
year	68·5	70·0
winter	64·4	61·5
spring	65·8	65·7
summer	72·5	80·2
autumn	72·3	72·5

The contrast will here be seen, between Algiers, a variable climate, and Funchal, an insular or constant one. It is very important to obtain the mean temperature, as well as the extreme temperature of a place, as by these are climate classed as constant, variable, or extreme. Thus Funchal is constant, London and Paris variable, Pekin extreme; though the second and last, as I have just said, are on the same isothermal line. I am uncertain whether the climate of this neighbourhood should be classed amongst the constant or the variable: for although our temperature is generally very steady, yet the diurnal range is considerable, and at times very great; but on the whole, I consider it entitled to be called a constant climate. We are indebted to the sea-breeze—tempering the heat of summer—for this equalization; it would not be felt further inland, and there greater variations of temperature might be expected. The climate of this colony, as well as of New South Wales, is salubrious, and very favorable to the European constitution; persons particularly who have arrived at, or passed, the middle age, in the more inhospitable climate of Britain, often have their health and vigour surprisingly renewed in this genial climate. Instances of persons arriving at great age are common,—persons nearly or quite one hundred years old being not unfrequently met with, and these generally retaining an amount of strength and activity to the last. From returns extending over many years, of the diseases of troops in foreign stations, I find that while the rate of mortality in the windward and leeward islands has been 93½ per 1000 per annum, and in Jamaica 143 per 1000; in Australia and the Cape of Good Hope the mean annual mortality has been at the minimum, or only 15 per 1000. On this point Sir George Ballingall says of New South Wales, "the climate generally is salubrious, although the heats in summer are excessive; the hottest and most unhealthy months are, November, December, January, and February; the mean temperature during these months is 80 degrees; March and April may be looked upon as the rainy season." The diseases occurring in Queensland from atmospheric causes, and most commonly noticed, are, ague, continued fever, chronic rheumatism, and influenza; the first two being caused by the exhalation of vegetable miasm, the next by undue exposure to wet and night air, the last by some unknown state of the atmosphere, producing at first ordinary colds which soon become infectious and epidemic. I will now make a few remarks on the results noted at this station (Brisbane), for a complete year, noticing each month, and each season, separately: premising, however, that as the observations have only been taken for two or three years, the results may have to be modified somewhat, after the observations have extended over a number of years.

Spring.—This season extends from September 23rd to December 22nd. In the last month of September the increased warmth of the weather will already be noticed, the mean maximum shade

temperature being 82 deg. Showers may be expected with misty mornings. The aurora already mentioned was seen in this week in 1859.

OCTOBER.—Temperature: Mean maximum shade.. 84·2
Mean temperature 71·6

For the last two years October has been gloomy and wet; in 1858 over twelve inches of rain fell in twenty days; and in 1859 the great hailstorm occurred which did so much damage in and around Brisbane. Squalls with thunder and lightning may occur.

Greatest diurnal range 36·8 (from 54 to 90·8)
Mean diurnal range 27·3

NOVEMBER.—Temperature: Mean maximum shade.. 83·3
Mean temperature 70·7

The weather this month has been gloomy and squally; rain, thunder, and lightning—the nights are still occasionally cold.

Greatest diurnal range 34·2 (from 54·8 to 89)
Mean diurnal range 25 8

DECEMBER.—Temperature: Mean maximum shade . 85·7
Mean temperature 73·5

December is frequently cool until towards the end, when summer commences; often fine pleasant weather with starlight nights and heavy dews.

Greatest diurnal range 30·6 (from 54 to 84·6)
Mean diurnal range 22·8

Mean maximum heat of spring..........	83·8
Mean temperature	71 9
Mean greatest diurnal range	33·9
Mean diurnal range	25·3

SUMMER.—This season comprises the time between Dec. 22nd and March 20th.

JANUARY.—Temperature: Mean maximum shade ...... 88·7
Mean temperature 77·8

Summer is now fairly set in, weather hot and oppressive, often with rain squalls, thunder and lightning.

Greatest diurnal range 31·9 (from 67·6 to 99·5)
Mean diurnal range 20·7

FEBRUARY.—Temperature: Mean maximum shade.. 87·3
Mean temperature 78·2

This is frequently the hottest month of the year; heavy squalls with thunder and rain are common, and strong easterly winds.

Greatest diurnal range 30·8 (from 63·6 to 94·4)
Mean diurnal range 19·9

MARCH.—Temperature: Mean maximum shade ...... 85·7
Mean temperature 76·2

Summer ends on the 20th; the heat though less than last month is still considerable. Easterly winds prevail with frequent showers.

Greatest diurnal range 27 6 (from 61·2 to 88·8)
Mean diurnal range 20·7

Mean maximum heat of summer	87·2
Mean temperature	77·4
Mean greatest diurnal range..........	30·1
Mean diurnal range	20 4

AUTUMN.—Comprised between March 20th, and June 24th:—

APRIL.—Temperature: Mean maximum shade ...... 81·6
Mean temperature 71·8

At the beginning of this month we may expect clouds and showery unpleasant weather; towards the end the S.W. weather, with heavy dews and positive electricity commences.

Greatest diurnal range..33·0 (from 48·1 to 81·1)
Mean diurnal range ....21·9

MAY.—Temperature: Mean maximum shade ...... 77·9
Mean temperature 63·3

Fine cool healthy weather; splendid clear starlight nights, heavy dews, and occasional hoar frosts. For three years the climate has been very equal this month, and less rain fallen, than in any month in the year.

Greatest diurnal range..34·9 (from 42·1 to 77)
Mean diurnal range ....26·6

JUNE.—Temperature: Mean maximum shade ...... 70·1
Mean temperature 58 2

As last month, S.W. weather may be expected, with strong positive electricity, bright cold starlight nights, heavy dews, and occasional hoar frosts.

Greatest diurnal range..38·7 (from 41·4 to 80·1)
Mean diurnal range ....22·5

Mean maximum heat of Autumn	76·5
Mean temperature....................	64·4
Mean greatest diurnal range	35·5
Mean diurnal range	23·6

WINTER.—Comprising the time between June 24th, and September 23rd.

JULY.—Temperature: Mean maximun shade ...... 71·6
Mean temperature 57·1

As the last months, cold seasonable beautiful S.W. weather may be expected, with little rain, heavy due, and foggy mornings, and occasional hoar frosts.

Greatest diurnal range 41·1 (from 34·3 to 75·4)
Mean diurnal range 29·0

AUGUST.—Temperature: Mean maximum shade ...... 72·3
Mean temperature 59·8

The instruments show an increase of one or two degrees of temperature, and seem already to indicate the approach of spring; the hoar frosts are gone, though the brilliant starlight nights, and heavy dews, and occasional foggy mornings, continue.

Greatest diurnal range 40·2 (from 43 to 83·2)
Mean diurnal range 24·0

SEPTEMBER—Temperature: Mean maximum shade ...... 81·1
Mean temperature 66·4

The brief winter finishes on the 23rd. Still warmer than last month. Wind chiefly S.W. in the morning, but the N.E. sea breeze now sets in in the afternoon, followed by calm nights.

Greatest diurnal range 36·5 (from 43 to 79·5)
Mean diurnal range 28·7

Mean maximum heat of winter	75
Mean temperature......................	61·1
Mean greatest diurnal range	39·2
Mean diurnal range	27·2
Mean maximum heat of year	80·6
Mean temperature of year	68·7
Mean greatest diurnal range	34·7
Mean diurnal range	24·1

The temperature of the year, then, as thus carefully ascertained we see is 68·7; almost exactly the same as that of Funchal, in the islan l of Madeira, which we have seen to be 68·5; and which place, as already stated, is in the corresponding isothermal belt of the northern hemisphere: being classed amongst the insular or constant climates, and of world-wide repute for the salubrity of its climate.

But while I unexpectedly find this almost exact coincidence of mean temperature, between Brisbane and Funchal, still I must notice that the range of temperature, both in summer and winter, is several degrees greater here than in Madeira; the summer here being a little hotter, and the winter colder. I shall add such particulars of Australian climate as I am able to obtain, particularly the rain-fall of this place, in a tabular form, which will be more useful for reference.

And now, in reply to those who have asked what is the practical use of this study of meteorology? and in conclusion, I would reply in the words of Lieut. Maury, whose works have been already quoted, where, having in his "Physical Geography of the Sea" described the "more than a thousand navigators, engaged day and night, and in all parts of the ocean, in making and recording observations according to a uniform plan," and resulting in the saving of much time and money to shipowners, goes on to say, "But these meteorological observations, which this extensive and admirable system includes, will relate only to the sea, this is not enough. The plan should include the land also, and be universal. Other great interests of society are to be benefitted by such extension, no less than commerce and navigation have been. A series of systematic observations, directed over large districts of country, nay, over continents, to the improvement of agricultural and sanitory meteorology, would, I have no doubt, tend to a development of many interesting, important, and valuable results.

The Agricultural Societies of many States of the Union have addressed memorials to the American Congress, asking for such extension, and it is hoped that that enlightened body will not fail favourably to respond. This plan contemplates the co-operation of all the States of Christendom, at least as far as the form, method, subjects of observation, time of making them, and the interchange of results are concerned. I hope that my fellow citizens will not fail to second and co-operate in such a humane, wise, and noble scheme.

The Secretary of the Navy, taking the enlarged and enlightened views which do honor to great statesmen, has officially recommended the adoption of such a system, and the President has asked the favourable consideration thereof by Congress.

These researches for the land look not only to the advancement of the great interests of sanitary and agricultural meteorology, but they involve also a study of the laws which regulate the atmosphere, and a careful investigation of all its phenomena."

Mean Temperature of Year and Rain Fall at the various Australasian Stations and at other Countries.

	Mean Annual Temperature of Year.	Mean Annual Rain Fall.	No. of Days Rain.
		Inches.	
Brisbane (Queensland)...	68·7	43	108
Port Macquarie (N.S.W.)	63·5	71	...
York (Western Australia)	65·3	25	...
Perth do.	65·2	...	...
Parramatta (N.S.W.) ...	61·1	...	...
Sydney do. ...	61·1	49	146
Adelaide	64·9	20	...
Melbourne	57·6	29	...
Launceston (V. D. Land)	53·2	32	...
Hobart Town do. ...	53·3	20	...
London	50·4	23	...
Paris	51	24	...
New York	53·8	...	...
Pekin	54·9	...	...
Funchal (Madeira).........	68·5	...	...
Algiers	70	36	...

I am indebted for some of the above figures to a paper on climate (by W. S. Jevons) in Waugh's Almanac, 1859.

NOTES ON THE GROUP OF ANIMALS KNOWN AS THE MARSUPIALIA.

THE FOLLOWING PAPER WAS READ BY CHARLES COXEN, ESQ., M.L.A., BEFORE THE PHILOSOPHICAL SOCIETY OF QUEENSLAND, ON TUESDAY EVENING, 5TH FEBRUARY, 1861.

Before treating on the habits, structure, and generalities of the group of mammals termed marsupialia (from *marsupium*, a bag or pouch), it will be as well that I should enumerate the principal genera belonging to the order, together with their distribution, they not being confined, as is generally supposed, to Australia.

The first-discovered species were found in America, and are contained in one genus, Didelphys, or American oppossum. One of these, the Virginian oppossum, is common in the United States, and some five or six other species are found in Mexico and South America. This genus, may be considered as the head of the group, from its possessing a higher degree of organisation. The species contained in this genus is confined to America (North and South): they are omnivorous, and are sometimes destitute of the abdominal pouch, the marsupial bones being only rudimentary. In New Guinea there are found several species affording examples of the genera phascogale (or brush-tail rats), perameles (or bandicoots), hysiprymus (or kangaroo rats), phalangista (or oppossums), and petaurus (or flying squirrels); to these may be added the dendrolagus (or tree kangaroo); of this genus, only two species are at present known, and these are confined to New Guinea. On the islands of Timor, Amboyna, and Banda are found several species of the phalangista (or oppossums). But the great metropolis of the marsupials is Australia, where (in addition to those already named), we find widely distributed the genera dasyures (or native cats), thylacinus (or hyæna of Van Diemen's Land), phascolarctos (or kola,) phascolomys (or wombat), echidna (or hedgehog), ornithorhynchus (or duck-billed mole), and the macropodidæ (or family of kangaroos.) The number of marsupials known in Australia exceeds seventy, and may be reckoned as forming four-fifths of the mammals of this continent and its adjacent islands.

Much discussion has taken place during the last thirty years as to the propriety of classifying the genera into one group, owing to their great dissimilarity in outward appearance and natural habits; some being omnivorous, some carnivorous, some insectivorous, and others herbivorous. Many of our eminent zoologists regarded the section marsupialia as an unnatural one, and arranged the species of this group in the various other orders of quadrupeds, and it was only after a careful investigation by Professor Owen, that all animals possessing the marsupial distinctions were admitted into one group or order. A few extracts from that learned Professor's papers on the "Osteology of the Marsupialia," will, I think, clearly show a different organisation, and justify the arrangement of a separate order. In the various memoirs on the anatomy of the marsupialia, Professor Owen has constantly found it necessary in his comparisons, to refer to the oviparous classes of vertebra:—"Both sexes in the marsupial genera," says this author, "manifest their affinity to the oviparous classes, in possessing two vena cava, and in the want of the inferior mesenteric artery, and the marsupial bones, so common in the skeletons of reptiles, are limited in the mammiferous class to this division, in which alone, from the peculiarly brief

period of uterine gestation, and the consequent non-enlargement of the abdomen, their presence might be expected. In the female they assist in producing a compression of the mammary gland, necessary for the alimentation of a peculiarly feeble offspring, and they defend the abdominal viscera from the pressure of the young, as these increase in size during their mammary or marsupial existence, and still more when they afterwards return to the pouch for temporary shelter." It is without doubt in the mammalia that the brain is perfected. "We can trace through the different orders the increasing complication of this organ, until we find it in man to have attained that condition which so eminently distinguishes him from the rest of the class; and if the introduction of new powers into an organism requires a modification in its mode of development, with what other than the perfection of the nervous system can we connect true viviparous or placental generation? for we do not perceive that in their digestion, circulation, respiration, locomotion, or temperature, the mammiferous vertebrata are in any degree advanced beyond the bird, in consequence of their more complex, or, as it may be termed, more careful generation." According to this view, Professor Owen undertook a careful examination of the brain of various marsupial animals, and the result was that besides the decreased size of the hemispheres of the brain and consequent exposure of the cerebellum, indicative of a low grade of organisation, the corpus callosum and spetum lucidum were found to be entirely wanting or at least existing only in a rudimentary state. The corpus callosum has been considered as the great characteristic of the brain in the mammalia, and the want of it in this order of mammals, coupled with the ovoviviparous generation of the marsupialia will, I think, warrant the placing of this order as the lowest organism in the class mammalia. The corpus callosum, which is the principal bond of union between the opposite hemispheres of the brain, is regarded as the great characteristic of the brain in the mammals, and in fact this commissural apparatus presents the essential difference which exists between that and the oviparous vertebrata classes. There is also a remarkable feature in the skull of the marsupials, which consists in the permanent separation of the greater portions of the bones; they do not anchylose in the adult individuals (as do most of the bones of the skulls in the placental series), the temporal bone generally presents a permanent separation of the squamous, petrous, and tympatic elements. "I have observed," says Professor Owen, "this reptile-like condition of the bone in the mature skulls of the marsupials." The palatine portion of the skull is very imperfect, presenting large openings which are wanting in placental mammals; there is also a peculiarity in the lower jaw in all the species of the marsupialia, with the exception of the Echidna and Ornithorhyncus—"the angle of the lower jaw is as if it were bent inwards in the form of a process encroaching in various shapes and degrees of development in the different marsupial genera upon the interspace of the rami of the lower jaw. In looking down upon the lower margin of the lower jaw we see, therefore, in place of the margin of a vertical plate of bone, a more or less flattened surface extending between the external ridge and the internal process or inflected angle."

One of the most striking peculiarities in the marsupial animals consists in the premature birth of their young, and consequently, the imperfect state of development which they present at this period compared with other animals. The period of utero-gestation varies considerably in the different animals of this group. On the macropas major, or large grey kangaroo, it is about thirty-nine days, after which time it continues its fœtal life in the pouch for ten or twelve weeks: the manner of conveying the embryo animal to the nipple, has not been fully ascertained, but I believe the mouth is the vehicle used. Professor Owen examined the young of the species above named twelve hours after birth: "It resembled an earthworm in the color, and semi-transparency of its integuments, adhered firmly to the point of the nipple, breathed strongly but slowly, and moved its fore legs when disturbed. Its body was bent upon the abdomen, its short tail tucked in between the hind legs, which were one-third shorter than the fore legs, but with the three divisions of the toe distinct; the whole length from the nose to the end of the tail when stretched out, did not exceed one-inch and one-sixth." Experiments have been made on a fœtus of three weeks old by detaching it from the nipple, and after an hour's separation, it, on being held to the nipple, regained its hold, and sustained no injury. When the fœtus is very young, it requires some little force to remove it, and in doing so an injury to the young animal might probably be done. Until it attains a certain age the pouch of the mother has its orifice closed, and as it were glued to the body of the parent by a peculiar secretion; as the young acquires strength this secretion disappears, and the young leave the pouch to return at will. They attain a large size before they entirely quit their retreat; and

a female, on being hard run with dogs, will frequently lighten her load by throwing out the young when they are one-third grown.

The old man kangaroo, as the male grey species is called, will sometimes run to a waterhole when pressed by the hounds, and there make a good fight, standing in about three or four feet of water, catching the dogs as they swim to him, and holding them under the water until they are glad to get away. When brought to bay they sometimes inflict very severe wounds on the dogs, and will at such times, if incautiously approached by man, seize the intruder and use him very roughly, throwing him down and stamping on him. In such cases it is best to lie perfectly still, as the dogs will draw his attention in some other direction. The largest species known at present is the "red kangaroo," or "soldier" of the interior; the female is of a leaden colour, and is known as the "blue flier." These are found on the borders of the plains amongst the small forests of myall and salt bush. They are very fast, and an ordinary kangaroo dog would have but little chance of catching one. Another large species, the black wallaroo, is found in high broken ranges, and on being disturbed, takes the most inaccessible places, and when followed by dogs, will not unfrequently beat them off. It is very fierce, strong, active, and dangerous to attack in its rocky home, without sure weapons. I have seen one throw a large and powerful kangaroo dog down a ravine of some thirty feet. Gould in his work on the macropodidæ, describes a large red wallaroo found on the Coburg peninsula as being very fierce and bold. These four species appear to comprise all the large and dangerous members of the family, the remaining species being very much smaller and easily killed, when caught. Some of them are found in high rocky hills, but mostly in scrubs and thickly timbered country. Some of the smaller species make nests of dried grass, where they secrete themselves during the day; amongst these latter ones there is the jerboa kangaroo described in Gould's work as bettongia penicillata. This interesting little animal is found on the Lower Namoi, and like other members of the genus, constructs a thick grassy nest in such a manner that it is difficult for a common observer to detect. The most curious part of their history, is the very peculiar manner in which they convey the grass to the spot selected for their nest; the tail, which is prehensile, is (as you will see by the drawing I lay before you this evening) curled round small heaps of grass collected together, and with its load the creature leaps homewards, carrying the grass hooped and secured by the tail, which is curved underneath.

Before closing this paper I will introduce to your notice the remaining genera of the marsupialia in their separate families. The family which stands nearest to the American opossum is the "Dasyuridæ" comprising three genera "Thylacinus," "Dasyurus" and "Phaseogale" all of these are carnivorous; the first is confined, I believe, to Van Diemen's Land of which there are but two species and they are very rare. Some years ago, in the early days of the colony, these animals were destructive amongst the sheep and lambs, but are now rarely seen away from the rocky uninhabited parts of the island. The second is common in all the known parts of Australia, and is comprised of some four or five species, two of which are well known as being very destructive amongst poultry and called native cats; one of these is brown with white spots, and the other black with white spots. The remaining genus Phaseogale is represented by the animal known best as the brush-tailed rat; this is also well known in our poultry yards. The family Phalangistidæ is the next, and is composed of three genera, Phalangista, Petaurus, and Phascolarctus—the first comprises the opossums: this genus numbers some twelve or fourteen species; many of them are known to us by their skins, particularly a species of Van Diemen's Land, which produces a very handsome and valuable fur. The second genus also comprises some twelve or more species, some of which are really very beautiful, and the skins when manufactured produce a fur almost as soft and fine as the famed chinchilla of South America. Some of this genus are very small, and very little exceed the common mouse in size. The last genus in this family is the phascolarctus or kola. The phalangistidæ are herbivorous, and of nocturnal habits, feeding at night on the leaves and young shoots of the eucalyptus and other trees, keeping during the day in holes in trees. The next family is represented by a single genus and a single species phascolomys or wombat. This animal is also nocturnal, and feeds at night on roots, herbs, and grass. It retires during the day to deep holes in rocks, or burrows made in loose sand. These burrows extend many yards. It is no easy matter to unearth these creatures, and the only method I am acquainted with is to dig them out; but the labour and time expended in so doing is so great that the wombat is seldom procured. The flesh is very good, and would be, I believe, much esteemed if it could be obtained by reasonable labour. The wombat has a peculiar manner of defending itself, which is particularly effective when attacked in one of the rocky holes they are frequently found in; as soon as he is alarmed, he hastens to the

farthest extremity of the low cave, and places himself in such a position that the rock protects his head and sides, and then with his hinder part towards the enemy, awaits the attack, but the instant it is touched the short hind legs are thrown up and no hold can be gained on its round hard hind quarters ; but the attacking party does not escape scatheless, for the head of the dog or the hand of the man, whichever it may be, is thrown off with such force against the side and top of the rocky hole as to lacerate it severely and cause a retreat to be made.

The ornithorhynchus and echidna are insectivorous, and differ but very little from the marsupials herein described, except in the dental formation, and the formation of the lower jaw ; in every other respect they have the peculiar character of the marsupials.

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PUBLIC HEALTH

IN BRISBANE.

A PAPER READ BEFORE THE MEMBERS OF THE PHILOSOPHICAL SOCIETY OF QUEENSLAND, AT BRISBANE, BY THE REV. R. CREYKE, DEPUTY-REGISTRAR.

Mr. Chairman and Gentlemen,—Having been asked to read "A Report on the Climate of Brisbane for the year 1860, derived from particulars obtained from the Meteorological Station; also a return of the number of Births and Deaths and remarks on the health of Brisbane during the same period," and having acceded to the request, I appear before you this evening for the purpose of fulfilling my undertaking, and I trust that what I read may not be destitute of interest, although I feel conscious that the subject might have been handled more skilfully, and that a better knowledge of disease would have enabled me to speak more scientifically, and to show how the human frame is influenced by climate, &c. However, a great part of this paper has been furnished me by Dr. Barton, and truly, if it were not that he had already read an interesting paper before this Society, and it were deemed right that, as a member, I should try and do something to support its existence, I should have declined this honor, and should have proposed that gentleman as the fittest person to dilate on such a subject as that chosen for our consideration this evening. As it is, I must ask you to be lenient in passing your opinion, and if I have not made the most of the materials furnished, still I hope the information placed before you may be productive of good, inasmuch as man frequently suffers ill, not because he is *unable* to discover any means of prevention, but because he does not endeavour to find them out. He becomes accustomed to certain evils, and fancies that they are necessary, whereas as soon as he is induced to seek for a remedy, as soon as he is led to believe he may improve his condition, once convinced of that, and his inventive genius will soon work a reformation. Now, although, so long as sin remains in the world, there will be sickness and death; yet, since by proper attention to temperance and sanatory regulations, the sickness amongst men may be diminished, and the average life of man may be increased, and since a frequent constant bringing the subject before the public may induce them to seek for each others welfare by endeavouring to discover the connection which may exist between climate and disease, and such means as may be conducive to mitigate those evils to which human flesh is heir, I trust that this paper may prove a fresh stimulant to the benevolent and scientific to apply their minds to a subject replete with so much benefit to their fellow-creatures, and thus be productive of good. Much of the information now presented to you has already been published in monthly or quarterly returns, but a report of the whole year with general remarks has not appeared, and it has been thought by some that it would be interesting to have the whole placed before them in one paper so that the climate, &c., of the year may be easily ascertained. With regard to the meteorological observations, no doubt they can be relied on, having been taken with care and attention by one competent for the task and interested in the pursuit of knowledge; with regard to the number of births and deaths, it is not so easy to speak confidently about the actual number which took place, since if rumour speak correctly, the registration both of births and deaths is sometimes omitted; and, until the people can be convinced that they are benefitted, if not directly yet indirectly, by registration, some will always be found who will try and evade the law. But it is to be hoped that before long as

much reliance may be placed upon the registration returns as on the meteorological, and that by due attention to the influence of the seasons upon the health, men of science and research may discover some means of diminishing the sickness caused by the various changes in the temperature.

In any country if a correct account were kept of all the births and deaths which occurred annually after taking the census, and also if the exact number of emigrants and immigrants could be ascertained, there would be no necessity to take another census, since at the end of every year the difference between the births and deaths, and emigrants and immigrants would at once show the increase or diminution in the population. Again, to quote from De Morgan on Probabilities—"If in any one year a complete census were made, *registering the age of every individual*, and if the deaths which took place in the 365 days next following the day of the census were noted, the law of mortality could be deduced; in such a case the numbers of the living at every age would be so large that the proportion of deaths among them in a single year could be safely depended upon for pointing out, with great nearness, the law which regulates the mortality of larger masses of people." Of course during that year it is supposed that there is no extraordinary epidemic raging; perhaps also considering that the population of Queensland is small, the law of mortality cannot be as correctly inferred as in Great Britain or in the sister colonies, Victoria or New South Wales, still if only when the census was taken on the 7th of April, each individual has given his correct age, and if for one whole year after that the deaths are accurately registered, stating the age and sex, those especially who are interested in insurance companies, might be able to form some tolerably correct tables upon which to base their calculations; whereas if no census had been taken, and if the deaths be not accurately registered during the following year, it is calculated that it would require an accurate register to be kept of births and deaths, and of incomers and outgoers for one century and a half to furnish data from which the law of mortality might be deduced.

I admit that these remarks may be considered irrelevant to the subject proposed for our consideration, but I trust I shall be pardoned for this digression since I am interested in the subject of registration; and it is especially desirable that when the country is put to so much expense in taking the census, all should endeavor, by answering the questions proposed (especially with reference to age,) and by carrying out the registration law relative to deaths, to make the returns as useful and comprehensive as possible. The climate of Moreton Bay is acknowledged by all to be healthy; and that the summer months are less healthy than the winter, is generally admitted. A table copied from the annual report of the Registrar-General tends to show that such is the case:—

Deaths Registered at Brisbane, during the four Quarters in the Year, 1857-58-59, and 1860.

Quarters.	1857. Males.	1857. Females.	1858. Males.	1858. Females.	1859. Males.	1859. Females.	1860. Males.	1860. Females.	Totals.
1st.	22	16	18	16	18	13	18	21	142
2nd.	11	4	19	7	20	10	24	10	105
3rd.	19	16	12	9	12	11	20	7	106
4th.	13	6	20	6	22	8	26	22	123
	65	42	69	38	72	42	88	60	476

The next table shows the difference of mortality during the four quarters of the year 1860, in the colony of Queensland, and it is curious to observe how, although in nearly the same number of deaths, the numbers in the first and fourth quarter differs; the numbers in the second and third are merely transposed.

Return of Deaths Registered in Queensland during the four Quarters of the year, 1860.

Quarters.	Brisbane.	Ipswich.	Drayton.	Warwick.	Dalby.	Condamine.	Gayndah.	Maryborough.	Taroom.	Port Curtis.	Rockhampton.	Totals.
1st.	39	40	11	15	8	2	7	6	2	4	17	151
2nd.	34	18	8	15	7	9	9	1	0	0	5	106
3rd.	27	18	16	8	11	4	6	4	3	1	7	105
4th.	48	16	7	15	7	5	2	4	2	2	8	116
	148	92	42	53	33	20	24	15	7	7	37	478

Whether the introduction of ice and the formation of public baths would tend to diminish the sickness during the hot season is worthy of consideration.

I will now proceed to read the monthly statements after which I propose to make some general remarks.

January.—The weather during January was hot and oppressive, and for the first ten days there was frequent thunder and lightning with rain squalls. The 13th was the hottest day of the summer in the sun, when the maximum shade registered 99·5, and the maximum sun 125·8. During the latter part of the month it was hazy; wind at S.W. The electrical state of the atmosphere as indicated by the gold leaf electrometer was very much disturbed, with the barometer low throughout. At sea, easterly winds prevailed with heavy weather. Mean temperature of month 77·1; mean temperature of month in Melbourne, 68·7; greatest diurnal range, 31·9; 2·54 inches of rain fell in nine days. The health was not good. The diseases most common were febrile debility, subacute bronchitis, bilious diarrhœa, and neuralgic pains of the face. 13 deaths were registered, 6 males 7 females; 1 death was from suicide, 1 from sunstroke; 2 were under one year, 6 under two, and 1 between two and three; 28 births were registered, viz., 16 males, 12 females.

February.—Easterly winds prevailed this month, and cloudy oppressive weather. The 19th was the hottest day of the summer, in the shade the thermometer marking 100·5. A negative state of electricity was noticed almost throughout the month, forming a strong contrast to the usual state of the atmosphere, and having a very depressing effect upon the health and spirits. During the month there was frequent distant thunder, with rain and lightning, nearly every evening. Mean temperature of month, 76·6; mean temperature of month in Melbourne, 65·4. Greatest diurnal range, 30·8; highest sun, 122·1. More rain fell than in any month since October, 1858, in which 12·10 inches were registered at the Cape Moreton station; the rainfall of the evening and night of the 21st was very great, viz., 2½ inches. The total rainfall of the month was 9.64 inches in 18 days. There was much sickness, and deaths were numerous. Bilious diarrhœa and colic seemed almost epidemic. External inflammation about the joints (in some cases connected with rheumatism, and affections of the tonsils and throat) was noticed in several instances. 19 deaths were registered, 11 males 8 females; under one year, 9; under five years 12; one 5 years and two months; 1 sunstroke; 1 accidentally drowned; 1 accidentally burned. Births 30; 15 males 15 females.

March.—As was the case last month, easterly winds prevailed nearly throughout, with heavy clouds, frequent showers and negative electricity. Mean temperature of month, 75·7; mean temperature of month in Melbourne, 66·6. Greatest diurnal range, 27·6; highest shade, 92·2; highest sun, 120·7; rain, 6·58 inches fell in 18 days. Health—Though fewer deaths were registered than in February there was above the average of sickness this month, arising probably from vegetable miasma, the result of great moisture with heat. Several cases of fever occurred, which, as the stomach or liver was chiefly affected, might be called gastric or bilious. In children catarrh and catarrhal ophthalmia were common; there were also several cases of scarlet fever. 7 deaths were registered, 2 males 5 females; under one year, 2; under five years, 5; two females died, one from amonorrhœa, one from fever produced by unhealthy condition of womb and intestines. Births 37; 21 males 16 females.

April.—Up to the 23rd cloudy weather with frequent showers, and wind chiefly from N.N.E. to E., and negative electricity. The last week fine cool weather, wind W.S.W. to S.S.W.; fine starry, moonlight nights, very heavy dew and positive electricity; pleasant seasonable weather. Mean temperature of month, 71·4; mean temperature of month at Melbourne, 58·8; greatest diurnal range, 33·0; highest shade, 91·4; highest sun, 118·0. Rain—7·55 inches fell in 18 days. Health—much sickness at the commencement of month; several cases of fever were again noticed, ending fatally in two instances. Colds and cases of chest affection were also common, the latter principally seen in persons arriving here to escape the winter of colder colonies. Deaths—13 were registered, viz., 11 males 2 females; under one year, 3; under eight years, 4; 4 consumption; 3 convulsions; 2 fever; 1 drowned. Births 34; 21 males 13 females.

May.—This month was fine and seasonable. Wind chiefly in the morning from W.S.W. to S.S.W. getting round in the afternoon to E.N.E., and calm at night. Beautiful cold starlight nights; heavy dew throughout, and strong positive electricity. Numerous shooting stars were noticed on the evening of the 16th. The S.W. winds having been light, the cold was less than in May of the previous year. The 22nd of May, 1859, was the coldest day of the winter, and was thus noted—"The night of the 22nd was very cold, 5 degrees below freezing. Growing plants were blackened and destroyed at Brisbane, Cooper's Plains, and Ipswich, the thermometers on the ground were coated with thick ice; the minimum shade thermometer, placed four and a half feet from the ground was only two and a half degrees above freezing point." The coldest night hitherto of this season was the 30th, when the grass thermometer registered 38 degrees, or 6 degrees above freezing. Mean temperature of month, 62·8; mean temperature of month at Melbourne, 54·7; greatest diurnal range, 34·9; highest shade, 81·6; highest sun, 106·8. Rain—Only twelve hundreths of an inch fell. Health—Very little sickness except some cases of colds and influenza; as usual also, some cases of chest affection were seen in persons from the south allured here by the mildness of our winter.

Ten deaths were registered, 6 males 4 females ; under one year, 3 ; under five years, 8 ; 1 adult, consumption ; 1 natural causes. Births—males, 9 ; females, 7 ; total, 16.

June.—This was a cool seasonable month ; light hoarfrosts on the nights of the 10th, 11th, 12th, 13th, 21st, and 22nd, although the thermometer only registered below freezing point on the 11th, when it marked 31 degrees. The prevailing winds were W.S.W. to S.S.W. ; fine starlight nights, and heavy dew ; the last few days cloudy, with rain and S.E. wind, positive electricity throughout. Mean temperature of month, 56·4 ; mean temperature of month at Melbourne, 49·7 ; greatest diurnal range, 38·7 ; highest shade, 80·1 ; highest sun, 102·0. Rain —·96 fell in two days. Health—Colds and influenza were common ; two cases of consumption ended fatally in persons from the south. Deaths—11 were registered, 7 males, 4 females ; under one year, 4 ; under five years, 5 ; 1 exhaustion after childbirth for want of proper attention. Births—boys, 22 ; girls, 13 ; total, 35.

July.—Foggy mornings with heavy dews were frequent ; slight hoar-frosts on the 18th ; wind, chiefly S.S.W. and S.W., and towards the end S.E. with heavy clouds ; mean temperature of month, 58·3 ; at Melbourne, 47·3 ; greatest diurnal range, 39·2 ; highest shade, 78·3 ; highest sun, 99·4 ; of rain, 49 hundredths of an inch fell in 7 days. Health : Influenza was so common that it might be considered epidemic ; several cases of measles and continued fever occurred ; sickness was above the average. Deaths : males, 9 ; females, 1 ; total, 10. Consumption, 3 ; dropsy, 1 ; atrophy, 1 ; enlargement of heart, 1 ; fever, 1 ; influenza, 1 ; drowned, 1 ; apoplexy, 1. Births—20 males, 13 females ; total, 33.

August.—The weather was very bad this month, with strong S.E. winds ; during the last week from the N.E. in the afternoon. Electricity negative up to the 11th ; after that moderate positive electricity, and stronger on the 16th, 17th, and 18th, during which three days there was beautiful clear weather, with starlight nights and heavy dews ; mean temperature of month, 59 degrees ; at Melbourne, 49·4 ; greatest diurnal range, 36·3 ; highest shade, 79·2 ; highest sun, 107·3. Rain, 12·39 inches : this very large quantity fell in seventeen days ; more than three inches fell on the day and night of the 10th. Health : There was very little sickness this month, with the exception of a few cases of influenza in children. Deaths : 8 ; 3 males, 5 females ; one, under 1 year ; three, under 5 years ; one child accidentally killed by a stick ; 1 puerpural mania. Births : 19 males, 14 females ; total, 33.

September.—This month the electrical state of the atmosphere was very much disturbed, as indicated by the electrometer, resulting in unhealthy unpleasant weather ; up to the 11th the electricity was negative, with easterly winds, heavy clouds, and lightning almost every night ; the latter part of the month finer, with wind chiefly from the S.W. and S.E., and the sea breeze in the afternoon with positive electricity and fine starlight nights ; squalls from S.W. on the evening of the 10th, with thunder, lightning, and rain ; strong W.S.W. gale on the 17th ; mean temperature of month, 62·7 ; at Melbourne 53.8 ; greatest diurnal range, 38·1 ; highest shade, 81·9 ; highest sun, 110 ; rain, 4·18 inches fell in 14 days. There was much sickness this month, amongst children and adults ; cases of measles, hooping-cough, erysipelas, chicken pox, many of influenza, and severe colds were noticed. Deaths : Males, 7 ; females, 2 ; total, 9 ; under 1 year, three ; under 5 years, four ; excessive drinking, 1. Births : 31 ; 16 males, 15 females.

October.—This month the wind was easterly almost throughout, from S.E. to N.E. with heavy threatening clouds and frequent showers ; electricity positive up to the 8th, afterwards negative or very slightly positive with frequent thunder and lightning at night ; unpleasant oppressive weather, but colder than usual at this season ; a beautiful lunar rainbow was seen on the evening of the second ; a pale silver shade, the arc extending from W. to S., with a dense thunder cloud behind it ; heavy squall on the evening of the 20th, from S.W. ; strong wind, with rain, lightning and loud thunder ; the hailstorm which in 1859 did so much damage in and about Brisbane, occurred on the 20th of this month ; mean temperature of month, 67·1 ; at M., 56·7 ; greatest diurnal range, 38·1 ; highest shade, 91·2 ; highest sun, 116 ; rain, 3·35 inches fell in twelve days. Health : Influenza continued prevalent, and there were many cases of hooping cough and measles, the latter principally at South Brisbane ; a case of cancrum oris after measles proved fatal. Deaths : 12 ; 9 males, 3 females ; under one year, 4 ; under five years, 9 ; 2 adults, consumption ; 1, general debility. Births : 44 ; 22 males, 22 females.

November.—On the 7th, 8th, and 12th, there was S.W. weather with strong positive electricity and great evaporation ; during the other part of this month the wind was chiefly from the N.E. with heavy clouds, negative or rather slightly positive electricity, the last day of the month was very hot, the thermometer in the shade marking 97 and the black bulb 121 degs. ; frequent thunder with lightning at night during the last two weeks ; mean temperature of month, 70·5; at Melbourne, 60·5 ; greatest diurnal range, 39·4 ; highest shade, 97; highest sun, 121·6 ; rain, 3·69 inches in ten days. Health : The deaths were numerous, resulting from various sporadic causes ; several cases of convulsions in infants, proved fatal, and there were four violent deaths. Deaths : 24 ; 12 males, 12 females ; under one year, 8 ; under five years, 12 ; under six, 14 ; 1 from exposure to sun ; 2 burned ; one from Guinea worm in leg ; 1 thrown from a dray ; 1 suicide. Births : 42 ; 16 males, 26 females.

December.—There were many showers this month, with thunder and lightning in the evenings. Barometer low throughout ; southerly

METEOROLOGICAL TABLE, WITH NUMBER OF BIRTHS AND DEATHS REGISTERED.—BRISBANE, 1860.

Months.	Latitude.	Longitude.	Height above mean sea level.	Mean Thermometer Shade.			Mean Wet Bulb.			Mean maximum shade.	Mean minimum shade.	Highest shade.	Lowest shade.	Greatest diurnal range.	Mean maximum in sun.	Mean minimum on ground.	Highest sun.	Lowest on ground.	Mean height of Barometer, reduced to 32° Fahrenheit.			Mean portion of sky obscured.			Rain in inches.	No. of days rain.	Mean temperature of month.	No. of Births.	No of Deaths.
				9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.										9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.					
January	27·° 5	153 °	70 feet	79·2	82·6	72·6	70·7	71·1	68	88·8	66·7	99·5	61·2	31·9	110·4	65·7	125·8	58·7	29·788	29·544	29·772	·55	·59	·46	2·54	9	77·2	27	13
February	,,	,,	,,	76·9	83·5	72·5	71·7	72	69	87·1	67·2	100·5	62·1	30·8	108·7	66.1	122·1	60.4	29·886	29·771	29.875	·70	·66	·60	9.64	18	76·6	30	19
March..................	,,	,,	,,	75·8	80·5	70·8	71	71·6	68·4	85·7	66·7	92·2	60·3	27·6	110·2	65·7	120·7	59	30·051	29·976	30·040	·59	·66	·55	6·58	18	75·7	37	7
April	,,	,,	,,	70·2	76·5	66·7	66·6	69	65	81·6	62·1	91·4	49·4	33	100·8	61·2	118	48·1	29.996	29·911	29·981	·54	·67	·54	7·55	18	71·4	34	13
May	,,	,,	,,	60·8	73·6	56·7	57·6	62·8	55·2	77·1	50·7	81·6	40·3	34·9	99·9	48·5	106·8	38	30·124	30·104	30·092	·32	·36	·19	12	4	62·8	16	10
June	,,	,,	,,	54·5	67·7	51 4	50·5	57·	48·7	70·8	44·5	80·1	32·6	38.7	92·9	42	102	31	29·967	29·875	29·940	·28	·37	·26	·96	2	56·4	35	11
July	,,	,,	,,	55·2	67·9	53·7	52·1	58·5	52·1	71·4	47·2	78·3	34·5	39·2	92·	45·2	99·4	33·1	30·125	30·001	30.103	·41	·52	·34	·49	7	58·3	33	10
August	,,	,,	,,	58·4	65·3	55·4	55·4	57·7	53·9	69·1	50·3	79·2	39·1	36·3	84·9	48·8	107·3	36·6	30·172	30·074	30·146	·55	·61·	·49	12·39	17	59	33	8
September.........	,,	,,	,,	62	69·5	58·7	58·2	61	56	74·3	52·7	81·9	42·3	38·1	96·1	51·2	110	40·7	30·081	29·966	30·051	·47	·57	·38	4·18	14	62·7	31	9
October	,,	,,	,,	68·5	72·8	63·8	63·3	64·2	61·3	78·1	57·8	91·2	49	38·1	99·9	56·2	116	47·4	30·040	29·926	30·003	·64	·63	·58	3·35	12	67·1	44	12
November	,,	,,	,,	74·4	77·2	66·8	66	66·4	63·1	83·5	60·1	97	50·5	39·4	108	57·6	121·6	46·5	29·930	29·829	29·905	·50	·49	·50	3·69	10	70·5	42	24
December	..	,,	,,	77·1	80·2	69·7	68·8	69·1	67·5	86·2	64·5	97	55·7	33·2	108·5	62·9	118·7	54·8	29·845	29·765	29·838	·62	·63	·41	3·14	15	74·5	23	12

winds prevailed from S.W. to S.E. and a disturbed electrical state of the atmosphere; there was a severe hailstorm on the afternoon of the 3rd; the pieces of ice, though not quite so large as that of the storm already alluded to, were projected with great violence from N.W. and did much damage. Mean temperature of month, 74·5; at Melbourne 66·3; greatest diurnal range 33·2; highest shade, 97; highest sun, 118·7: rain, 3·14 inches fell in 15 days. Health: Measles and hooping cough were still prevalent amongst children; several cases also of colic and diarrhœa occurred. Deaths: 12; 5 males, 7 females; under one year, 4; under five years, 7; 1 executed; 3 adults, consumption. Births: 23; 13 males, 10 females.

The mean temperature of 1860 was 67·7 which is exactly one degree below the average. This can be accounted for by the coolness of the summer up to the end of December. The rainfall was above the average; more than 54½ inches having fallen in 144 days. The mean temperature in Melbourne during 1860 was 58·1.

One thing seems quite evident from the above monthly statements, viz., that there is a great connection between the electrical state of the atmosphere and health. Whether science will enable men to overcome the want of electricity in the atmosphere remains to be proved. Inasmuch as the earth is the great attractor and reservoir of electricity, it seems as if it would be impossible, by any human contrivance, to charge the atmosphere with it, and perhaps it may be the will of the Diety to shew men that, although they can do much to prevent disease and sickness, there are some elements which they cannot control, there are some difficulties which they cannot overcome. Nevertheless, religion does not forbid investigation into the laws of nature, and as steam, the winds, fire and water, have all been made in a greater or less degree subservient to man, and contribute to his comfort, so the time may not be far distant when more shall be known about electricity, and our knowledge of its properties and laws may enable us, in some measure at least, to make it subject to our will.

Twenty two persons were registered during the year as dying from Consumption, of these twelve or more than 50 per cent. came from other colonies, chiefly from Victoria. Two observations Dr. Barton has stated may be usefully offered from the above. The first is, that experience has shewn that those persons who derive most permanent benefit from this climate in the relief of pulminary disease are those who have suffered from inflammatory attacks of the chest rather than from disease the result of tuberculous deposition; the former being much benefited by the warm steady climate, whilst excessive debility and derangement of the digestive organs are apt to prostrate those in whom the organic leision exists. The second observation is that persons labouring under advanced phthisis should carefully consider before leaving the comforts of a home, whether any reasonable hope can be held out to them of much benefit by any change of climate; and whether the change is not, in fact, the going away from friends to die, perhaps in a crowded noisy inn, amongst strangers. This is so well stated by Dr. Thomas Wilson, Professor of the Practice of Physic in King's College, that his words are here quoted:—

"Where tubercles actually exist and are ascertained to exist in the lungs, may the progress of the disease be ever suspended by a change of climate? Indeed I believe it may; but only in certain cases, and in certain stages of the disease. When phthisis occurs in either of its slow and unmixed forms, the question of a change of sky will be worth entertaining. In that form in which tubercles remain long in the crude state, I believe life may be preserved or lengthened by leaving this country (England) and residing under a higher and more equable temperature, provided that no softening of the tubercular matter has taken place; and in the other form when a vomica or vomicœ have occurred and the strength is apparently restored, and the remainder of the lungs give out the sounds of health. In that case also I would recommend a voyage to a milder climate to those persons who could afford to migrate, and to whom it was a matter of importance that they should prolong their earthly existence. I believe there is no place to which such persons could go with more hope of benefit than to Madeira. If however the lungs are already in a state of rapid disorganization, no benefit, but on the contrary much inconvenience and useless expense will result from change of place unless that place in which the patient is residing be notoriously unhealthy. When I am asked about removal either to another country or to some distant part of our own, and the state of the patient is such as I have just alluded to, I always advise that he should not forego the comforts of his home, and leave his family and friends, and seek advantage which he will not find amongst strangers, and amidst the discomforts of a lodging perhaps, or an incommodious dwelling. I think it cruel and wrong to send people away merely to die; and that many are so sent, to this place and that, in the almost certain prospect of their never returning, no one I think can doubt."

Since in a lecture given at the School of Arts Dr. Barton shewed that the climate of Brisbane corresponded in a great degree with that of Funchal the capital of Madeira, we might with propriety substitute the word Brisbane for Madeira in the above remarks; and doubtless when our climate becomes more generally known, and when more accommodation has been provided for invalids, many will crowd here from the neighbouring colonies, and be greatly benefited by the change, as they are by a visit to Maderia from England. But I feel confident that as yet many have been deterred from taking such a step, from a knowledge that there are very few comfortable lodgings to be

procured, and those who may have derived good from their residence here, have nevertheless dissuaded their friends from taking so long a voyage, there being so little certainty of comfort at the end of it.

Of the 478 deaths which occurred in the colony during 1860, 85 are specified as resulting from external causes, *i.e.* more than 17 per cent. 22 out of the 85 were drowned *i.e.* upwards of 4 per cent. of those who died. In a new country more lives are sure to be sacrificed to floods than in a settled district, but the per centage is great. When bridges are built, and the means of communication between places are improved, we may hope to have to record fewer deaths from that cause.

Although few are actually registered as having died from intemperance, nevertheless it is much to be feared that indirectly many have fallen a sacrifice to the abuse of alcohol. The abuse of what may be lawful in itself, will always prove a fruitful source of disease. Although climate may have much influence over the human frame, and although the want of electricity or too much moisture, or various other causes, may induce a predisposition to disease, nay may perhaps in some cases cause it, yet there is little doubt but that man, through want of temperance, and, through want of proper control of his passions, is a greater enemy to himself than the worst of seasons. If men had greater regard for the moral law of the Diety, there would be less necessity for them to trouble themselves about the natural laws of the Diety. Still since men will act foolishly and sinfully, and since climate does affect the constitution of man, if any means can be discovered for neutralizing its effects, all honor be to him who may be the discoverer.

28 per cent. of the deaths which were registered at Brisbane during 1860 were caused by Zymotic diseases* 18 per cent. died from this same class at Ipswich; 12 per cent in the other parts of the colony. In Sydney the average during three years was 17.84; in Brisbane during the same period it was 15.34. There is only one death entered at Brisbane during 1860 as unspecified, not one at Ipswich, whereas there are 33 unspecified in the other parts. Of those 33 most probably some were caused by Zymotic diseases, still in the country fewer deaths are likely to occur from that class of diseases than in towns. In Sydney the average per centage of deaths from that class is greater than here during the years 1857, '58, and '59. The mortality in Sydney may I believe be in a great measure attributed to a want of proper drainage, and it is sincerely to be desired that great attention may be paid in this city to that most important matter. It is, I believe, admitted by all writers on sanatory measures, that the best safeguards against all febrile diseases are, 1st. A copious supply of pure water. Secondly, good drainage, and thirdly, well ventilated dwellings. Happily for us it is in our power to possess all these three requisites, and I hope before long they will be possessed. Electricity may baffle us, but the procuring an abundant supply of water, the construction of good drains, and the proper ventilation of buildings are easily to be obtained. It is satisfactory to know that a paper is about to be read on this subject at the next monthly meeting.

Before closing this, some notice ought perhaps to be taken of the infantile mortality which is very great. The average per centage of deaths registered at Brisbane during the years '56, '57, '58, and '59, was of children under 2 years, 35·33, and under 5 years, 43·28. More than two-fifths of those born have died before they were 5 years old. During 1860, upwards of 50 per cent., or more than half of those who died had not lived 5 years. Can nothing be done to save so much life? In England alas, where there is so much poverty, and where it is so difficult to find employment for all, children are by some parents looked upon as an evil, and their death is too often welcome, but in this country, where population is really required for the development of its resources, every child is of value merely in a political point of view. To diminish the deaths amongst children is of as much importance as the bringing out of immigrants, and we are nationally interested in the health and prosperity of the young.

Diarrhœa and convulsions are the principal causes of death amongst children, and I cannot but think that many parents are culpable in allowing their children to eat all sorts of trash, which must have a tendency to derange the digestive organs. Sufficient care also is not taken by many to protect them from the rays of the sun. When we consider that exposure to heat is trying to adults, how much more so must it be to infants? Attention to diet and protection from the heat of the sun would doubtless spare the lives of many; and parents, who in their old age have no child to care for them, would, with proper attention and management, be blessed with healthy sons, who might be a comfort and a support to them. Not but that, in a hot climate like this, infants have much to contend against. During the summer months the heat must tend to weaken the mother, and the nursing child will sympathize; hence if hooping cough, measles, or diarrhœa are prevalent, many, from want of powers of resistance, fall a sacrifice. Few parents would be so unnatural as to be indifferent to the life of their offspring, and in a country where there is no pinching poverty to dry up all their finest and best feelings, and where, instead of looking forward to a life of wretchedness and misery for their offspring, they may reasonably hope that they will do well and

* The term Zymotic is given to those diseases which are caused apparently by the reception into the system of a virus or poison, which is diffused through the frame and operates upon it like leaven. Measles, Smallpox, Scarletina, Hooping Cough, Diarrhœa, Remittent and Infantine Fevers are amongst this class.

prosper in the land, they will no doubt allow their natural feelings full play, and will heartily rejoice in those children with which the Almighty may have blessed them, still many err from want of consideration and self-control, and from a neglect of those remedies which the Deity may have placed at their disposal.

And now gentlemen, I must conclude. I wish I had had some books of reference in order that I might have made this paper more interesting: however if my life be spared, and nothing prevent, I may perhaps, some few years hence, undertake to read a paper on a similar subject which shall be more comprehensive, and more likely to gratify my hearers.

GEOLOGY OF NORTHERN AUSTRALIA.

A PAPER COMPILED BY MR. A. C. GREGORY, AND READ BEFORE THE MEMBERS OF THE PHILOSOPHICAL SOCIETY OF QUEENSLAND, ON TUESDAY, JULY 2.

ON THE GEOLOGICAL CHARACTER OF NORTHERN AUSTRALIA, AS AFFECTING ITS GEOGRAPHICAL FEATURES.

The following paper has been compiled from my notes and journals, during the period I was in command of the Expedition, which was despatched by the Imperial Government to explore the N.W. portions of Australia in the years 1855-6; and although already in substance printed in England, by order of the Parliament, has not been available to the Queensland public. As the settlement of the northern portions of the continent is a subject of great importance to this colony, it appears desirable to facilitate the access to every source of information which may exist with reference to its general character and facilities for occupation.

The portion of the continent to which I purpose to confine my remarks is that which lies to the northward of latitude 23½ deg., or in other words, tropical Australia, and this I shall subdivide into two portions, the eastern and western, divided by the 143 deg. of longitude. The former consisting of a series of elevated ranges of hills, in which the older rocks are largely developed, and the latter an almost unbroken table-land of sandstone, belonging to the upper series of the carboniferous system.

The most remarkable feature of the western division of tropical Australia is, that it consists of an elevated tableland without a single known hill or range rising above the general level of its surface, and though when traversing the wider valleys they appear to be bounded by ranges of hills, yet on ascending any of the higher ground it at once becomes evident that the valleys are simply excavated and that the whole has originally been one vast plain, portions of which have been removed and the hills are only portions which have not yet yielded to the action of the elements.

From Roebuck Bay on the N.W. coast to nearly the southern part of the Gulf of Carpentaria, the country rises abruptly within a few miles of the coast to an elevation of from 500 to 800 feet; beyond this the rise is so gradual as only to be detected by barometrical observation, the greatest elevation being in latitude 18 deg., where it is about 1200 to 1600 feet above the sea level; to the south of this it gradually declines, so that in latitude 20 deg. the general elevation does not exceed 1000 feet.

Thus the 18th parallel of latitude becomes the line of division between the waters flowing to the coast, and those which descend into the desert interior. It also appears to be the limit

of the regular tropical rains, which do not seem to extend their influence further south ; and this, combined with the level sandy nature of the surface, sufficiently explains why the water courses descending into the interior never attain any considerable magnitude or importance.

The upper stratum of rock forming this level tract is a ferruginous sandstone, the superficial beds of which are formed by the aggregation of small concretionary masses, which are easily separated, and form an ironstone gravel, which is remarkably frequent on the western coast, gradually diminishing to the eastward. This rests on a coarse sandstone, varying from 50 to 300 feet in thickness.

The decomposition of this rock has covered its surface with sand of a red colour, and the whole country would have been one vast tract of desert had not the continued action of currents of water excavated immense valleys, and thereby exposed the lower rocks.

Immediately below the sandstone, thick beds of soft shale exist, and these so readily decompose into soft clay that when once exposed to the action of the weather, by the removal of the superincumbent sandstone, the whole bed is quickly washed away by the heavy tropical rains, leaving many isolated portions which, being still protected by portions of the superincumbent sandstone, form hills with steep sides and flat summits surrounded by low cliffs, giving a remarkably regular and monotonous outline to the features of the country throughout the whole tract where these rocks prevail.

Beneath the shales, beds of chert, passing into silicious limestone, were observed wherever the upper beds were removed. But though limestones are usually rich in fossil remains, I was unable to detect any which would afford a clue to the relative age of this rock. Near the Gulf of Carpentaria, it approaches so closely in character to the celebrated lithographic limestone used for printing, that there can be little doubt that it is equal to that procured from the German quarries.

The strata of this limestone are nearly horizontal, but not always quite conformable with the upper sandstones, and in the valley of the Victoria River it rests on, or passes into a hard jasper rock, veined with red and white, capable of receiving a high polish.

The next rock in the descending series is a hard white sandstone, of so compact and even texture as to almost resemble quartz. The stratification is so indistinct that it is scarcely possible to ascertain the dip of the beds, but it seems to rise unconformably through the upper rocks, and forms low ridges of a very rugged character. No fossils were observed, but veins of sulphate of pyrites were very frequent.

Basalt is largely developed in the valleys of the upper part of the Victoria River; it also appears at the head of Sturt's Creek which flows into the desert interior, and on the Raper River, on the shores of the Gulf of Carpentaria. There are also small tracts of basalt along the edge of the table land towards the Gulf, but not forming very important features of the country.

The relative age of this rock is distinctly referable to the period immediately preceding the deposition of the highest beds of the upper sandstones, as it is often exposed as interstratified. The lower beds, much altered by the contact of the melted rock and those above, shew traces of being partly derived from the decomposition of the basalt.

The beds of Basaltic Rock are nearly horizontal, and the general form of the surface of the country does not indicate any great change since the fluid rock filled the valleys.

No trace of slates or schistoze rock of any kind was observed, and in three isolated cases where granite was exposed it was in immediate contact with sandstone.

After travelling over nearly 1000 miles of the table land just described, the extreme monotony of feature is suddenly intercepted at the 143rd meridian, and the eastern division of tropical Australia being entered, the boundless plains and sandy deserts are exchanged for bold ranges of hills of granite, slate, porphyry, and trap rocks, in the relative positions of which the effect of great disturbance is everywhere evident, but the limits of this paper will not admit of more than a general view of their geological arrangement.

The ranges of hills are nearly north and south, the western acclivity is usually easy and the eastern slope abrupt, while each succeeding range as we proceed eastward rises to a greater elevation ; thus the range between the head of the Lynd River and the Gulf of Carpentaria is 2500 feet above the sea level, that between the Lynd and Burdekin Rivers or the watershed line is nearly 3000, while some of the ranges on the east coast are 5000 feet in elevation, forming the boldest features of the Australian coast.

Granite, though frequent, especially on the eastern slopes, is not so largely developed as the superincumbent slates, which are so much disturbed that it is scarcely possible to generalize the dip of their strata.

These slates are very variable in character, some parts a fine blue roofing slate with even and fine cleavage, while in other parts it assumes more the appearance of a sandstone rock intersected in all directions by thin veins of quartz.

Interstratified with the slate there are thick *beds* of quartz, which sometimes form small hills, but it is not a rock favourable to the development of metallic minerals, such as gold, silver, or copper, for though to the general observer there is no difference in the appearance of *bed* and *vein* quartz, they are geologically totally distinct, the latter being the description which accompanies the gold of Victoria and New South Wales.

Vast masses of porphyry have been erupted through the slate, and this rock frequently contains fragments of granite and slate embedded in it, clearly indicating a more recent date than either of the rocks of which it contains the

fragments. Like most erupted rocks, it forms hills, or groups of hills, without any definite arrangement, on the slope of the ranges of older rocks.

At a still later period there have been extensive outbursts of basalt, which exhibits such a scoriaceous character that it might be mistaken for lava. There is, however, strong evidence of its flowing from fissures, and not being erupted from cones.

Overlying these rocks is a bed of sandstone, full of water-worn quartz pebbles, which appear to indicate that the whole of the country was submerged at the time, or at least subsequently to the last outburst of the basalt.

The sandstone is usually most largely developed on the summits of the ranges, or at least is most conspicuous in this position, and as its character is very similar to the upper sandstone of the western table land, it may be referred to the same period, though, there being no fossils observed in either, it is not certain.

It was only after passing to the south of latitude 20 deg., that there was any decided indication of the existence of coal, and in latitude 23 deg. coal-bearing strata are largely developed, forming the Peak Downs, from which this valuable mineral seems to extend with little interruption southward to latitude 28 deg., a distance of 350 miles.

As the most recent rocks which have yet been observed belonged to the highest member of the carboniferous series, or new red sandstone period, and as this overlays all the higher summits yet examined, it would appear that the whole of Intertropical Australia was submerged at a period immediately subsequent to the carboniferous period. That before the deposition of any of the newer series of rocks the whole of this portion of the continent was raised above the ocean, that portion westward of the 143 deg. meridian by an equal or nearly equal force, which scarcely disturbed the strata, and thus formed a vast table land, the edges of which have since been segregated by waters flowing over its edges, thereby forming the valleys of the present rivers and creeks.

Eastward of the 143 deg. meridian, the elevating forces seem to have been much more active, the greatest intensity being along the eastern coast, which would appear to have been raised at first to much a greater height than it now retains, as the entrances of some of the rivers indicate a gradual subsidence of the land —a view which accords with the theory which has been deduced from the coralline structure of the Great Barrier Reef which fronts this coast.

Assuming the foregoing data to be correct, it would appear that Australia is the oldest persistent continent in the world, as every other country exhibits unmistakable evidence of one or more submergences since the new red sandstone period, and it is a remarkable coincidence that the existing animal and vegetable kingdoms in Australia, approximate more closely to the extinct fauna and flora of past ages, than those which now exist in any other country.

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ON THE SEWERAGE OF TOWNS.

A PAPER BY W. COOTE, ESQ., C.E., READ BEFORE THE MEMBERS OF THE PHILOSOPHICAL SOCIETY OF QUEENSLAND, AT BRISBANE.

There is scarcely any provision more necessary for the permanent health of the inhabitants of a town, and scarcely any one more generally neglected, than that of efficient sewerage. I do not mean drainage, which is a distinct matter. From not keeping this in view much confusion has arisen; and from attempting to combine both in one system, great evils have often followed. In climates like ours, such evils would be greatly multiplied, and hence the necessity for a clear apprehension of our requirements, and the provision to be made for them.

In founding a city in ancient times, the water supply and the sewerage were thought matters of almost equal moment. Every schoolboy has read of the Cloaca Maxima of Rome, which was but one amongst almost innumerable instances of the care which the Romans took in the preservation of cleanliness and health wherever they settled. In modern times we generally wait till the soil is permeated with noxious gases, and then establish a sanitary commission, often composed of very unscientific members, by whom much twaddle is talked, and more money wasted. Moderate precaution at the outset would leave no excuse for the commission, and save the waste of both time and expense.

The first attempt at sewerage in Brisbane, as elsewhere, has been the digging cesspools to every house, sometimes steyned with dry bricks, and sometimes left without any lining. In all cases where wells or tanks are sunk within a moderate distance of such cesspools, the fluid content of the latter percolates through the soil and drains into them. Where no wells exist, the soil around the cesspool becomes impregnated with fœtid matter, which evaporates after every rainfall, and contributes largely to the promotion of malaria, fever, and the incomes of doctors and undertakers. It is supposed that economy is obtained by the adoption of these cesspools, but leaving the doctor's bill out of the calculation, it is very questionable whether the original cost of one, supplemented by that of the emptying and keeping in repair, is not more than would be required for the provision of efficient drainage for the house to which it is appended.

Supposing the inhabitants of any city to have arrived at this conclusion, and to have determined on the construction of adequate sewerage, the first step is to ascertain the outfall and the general levels of the district. This is best done by what are called contour lines—levels along streets only being not sufficient for the purpose. A contour line is one traversing every portion of a district which is on the same level. They may be taken at vertical distances of 2 feet—*i.e.* each line 2 feet below the level of the preceding one. The horizontal distance will be in proportion to the unevenness of the ground, becoming small when it is precipitous, and large as the slope is more gradual. These lines being accurately taken, it is easy to ascertain the difference of level between any points within their range. In all cases where a general system of drainage or sewerage is to be laid down, these contour lines are indispensable, and are now almost universally adopted on the continent of Europe as well as in Great Britain.

The levels and the point of outfall being ascertained, the separation of drainage from sewerage is next to be considered. By drainage is meant the carrying off surplus surface water; by sewerage the conveyance of sewage to some fixed reservoir or outlet, where it will cease to be a nuisance. The two cannot well be combined, the conditions required for their discharge being essentially

different. The sewage from any given number of houses can be estimated and provided for as a tolerably steady and continuous flow; but the rain-fall in this country is not to be guaged thus. It would require at one time very large discharge pipes, and at another very small ones; but pipes or sewers of large sections would be almost useless for the transmission of sewage, and indeed very mischievous, as retaining the solid portion of the matter they were intended to carry off. Surface water from streets, especially if on a declivity and having a sandstone formation like most of ours, carries with it a quantity of silt, or fine sand. This, if conveyed into small pipes, gradually but surely chokes them—if into large sewers, forms deposits on their lower surface which become obstructions to the passage of sewage over them, arresting the solid portion and retaining it to accumulate noxious gases, which sooner or later escape and poison the atmosphere. And, moreover, if the sewerage pipes be laid down with regard to their efficiency as such, a sudden rush of storm water, being too great for their capacity, will burst them at the junctions. Hence surface drainage should be carried off by surface drains. The term "surface drains" is not intended to mean the street-side channelling, as it is called, which is generally supposed to be, and is not, adequate to the purpose, but sunk channels of proper section laid to the required level. These channels need not be more than 9" in diameter, and about six inches in depth, laid close to the kerb. Their smooth surfaces offering no obstruction to the water, it would flow with great velocity, and rarely exceed the channel they afford. The junctions should be curved so as to aid the flow of drains on the lower level, and the sizes should be graduated by the relative positions of the streets, increasing as they approach the point of final discharge. A very slight fall, such as 6 inches in 100 feet, is sufficient in such cases, but the channels should be laid truly and well bedded. The cost of repairs would in that case be inappreciable.

For sewers, the first consideration is the main outfall, and this again has two points connected with it:—1st. Whether the sewage is to be collected in a reservoir and employed as manure. 2nd. If it is to be discharged into some contiguous stream.

Of late years there has been much controversy touching the employment of sewage as a manure. Of its fertilizing power there is no question, but the economy of its conversion remains to be proved. Various processes have been invented for the deodorization, as it is called, of the sewage, and for the evaporation of the fluid so as to leave the residuum in the shape of a powder; but the cost of the process seems in all cases to have exceeded the revenue it yielded. If the local circumstances of a town render the collection of the sewage a necessity, then the best method of use for manuring purposes seems to be that of keeping the mass in a fluid condition in an air-tight reservoir, and its conveyance in tank carts with pierced discharge pipes, like those of ordinary water-carts, to the place where it is to be used. This is not difficult, for the proportion of solid to fluid in sewage is exceedingly small. When the only natural outfall from a town is a fresh-water stream of limited capacity and subject in drought to shallowness, some such method as that described must be adopted or the stream itself will become a huge open sewer, poisoning the atmosphere and polluting the water for many miles. One or two philosophers have indeed asserted that the deodorizing power of fresh water is such as to neutralize the noxious gases held by sewage; but, setting aside the question at what relative quantities the supposed effect ceases, it may be sufficient to say that the theory has as yet secured no adherent beyond its first propounders.

When a broad and deep river, sufficiently affected by the tide to be salt, is available, there is no objection to a discharge of sewage into its waters, but the method is open to discussion. Some engineers advocate the construction of a mouth to the main sewer between high and low water mark, closed at flood and open at ebb tide. A self-regulating valve is easily appended to such an outlet. Others are in favour of the mouth being placed permanently below the low water level, the sewage being left to mingle with the stream as it best may; and probably this is not merely the simplest but the least objectionable method, especially where, as in a town like Brisbane, several outlets would be available and indeed necessary. Care, however, should be taken that the outlet is carried to as great a depth in the stream as the navigation will allow, and that its mouth is turned in the direction of the ordinary current.

The outfall and its method being decided, the material form and size of the sewers is next to be considered. Any absorbent substance is objectionable, as tending to the escape of noxious matter into the adjacent soil, and as hindering the flow of the sewage. Wood is obviously the worst possible material. Bricks, as commonly made, are also objectionable, for they are most generally of a very inferior kind, absorb almost as rapidly as ordinary soil, and the mortar joints soon give way. What are called dry brick barrel drains—*i.e.* formed of brick without mortar—are merely elongated cesspools. Glazed stoneware is the best of all materials within the limits of size to what it can be applied, its smoothness offering no obstruction to the flow of the sewage and its impermeability preventing the percolation of feculent matter into the soil. Next to this, hard-burned but slowly-burned bricks, made of strong clay with an adequate mixture of coal cinder (technically called breeze) set in cement, are most approved.

Some years back, when the question of sewerage received the attention it required, much dishonest disputation took place as to the material, form, and size of sewers and drains—disputation in which the advocates on both sides went to the most extraordinary extremes. Those who

defended the then existing system—or rather no system—adhered to the largest sized sewers with flat bottoms and straight sides, and would have had straight tops also had not the superincumbent earth required an arched form for its support. They went so far as to say that no sewer, as distinguished from sewage drains, should be built of a less size than would allow a man to walk in at his ease, so that the bottom should be cleansed when required. They did not see that a form of sewer which involved such aid must from that fact be defective, and that the necessity for the cleansing and for the dimensions, sprang from some error in the design. The propounders of small pipes went to the opposite extreme, assertions being made that an 18-inch pipe would be sufficient for the largest branch sewer in London. In this tumult of controversy facts were distorted, mis-stated, or ignored, and a vast amount of virulent abuse distributed. The lapse of time, however, seems to have settled the question. Many experiments have been made, and sometimes on a very large scale, on the drainage of towns, and it seems conceded that where the flow of sewage is considerable, objections exist to the employment of stoneware pipes beyond the dimension of 1 foot 8 inches by 1 foot, the section being egg-shaped. Ordinary street sewers can scarcely require a larger section ; but when the sewage of a considerable number unites, recourse must be had to the brick sewer for strength, continuity of bearing, and consequent evenness of surface. Beyond the size named it is not possible to turn pipe sewers with that straightness of line which is essential to the level of a sewer and to the perfect junction of the connecting ends. It was only after much time had been lost and many failures experienced that this conclusion was, and then most unwillingly, acquiesced in by the advocates of the stoneware sewer.

The form of the sewer, after equal debate with that which took place respecting its size, seems gradually to have been determined on as much from experience as from theory. Whenever the section exceeds the general dimensions of 9 inches by 6 inches, the egg shape is adopted; below that size circular pipes are employed. The argument in favour of a circular section over a right-lined one is brief and apparently conclusive; the greatest possible reduction of friction is desirable in sewers, and as a curve presents within a given length of perimeter less surface than a square, so a curved channel—other conditions being equal—must afford less friction than a square one. But inasmuch as the quantity of sewage is unavoidably to some extent variable, and the necessity existing for making provision in large sewers for an additional quantity arising from the increase of buildings would render the channel unnecessarily large for current purposes, were the simple circle retained, a shape like the section of an egg has been devised, which combines the maximum of strength, efficiency, and economy. The size of such main sewers must manifestly be determined by the estimated quantity of sewage they are to be constructed to convey, in which the future as well as the present must be considered.

When the egg shape is not available and other circular forms are not to be obtained, the bottom of the sewer should slope at an angle of not less than 45 degrees. The worst form of all is a sewer with straight sides and a flat bottom. Sewage drains from houses, if of stoneware pipes, need never exceed 6 inches in diameter, and indeed a 4-inch pipe will generally be found sufficient. These are not statements based on theory, but are derived from a vast number of known and recorded facts. The following rule has been given as a good one for the construction of sewers :—

If the diameter of the top arch be	1
Let the diameter of invert arch be	·5
And the total depth	1·5
Then the radius of the arcs which are tangential to the top arch and the invert will also be	1·5

In other words, the total depth of the sewer being six feet, the diameter of the top arch will be 4 feet, that of the invert 2 feet, and the radius of the side 6 feet.

The fall of drains and sewers must in some measure be regulated by natural slopes ; but a rapid incline, followed by one much less steep, is conducive to the accumulation of silt at the junction. All connections on the same level should be circular, and the intersection of pipes with sewers should take place at not more than half the height of the sewer, the pipe projecting slightly, if practicable, beyond its face. A fall of not less than an inch in 10 feet is desirable, and greater than 2 inches in 5 feet is objectionable, unless tolerable uniformity of slope can be secured. In pipe sewers from houses, the fall may with advantage be more rapid.

When the local peculiarities of ground preclude a connected or rather continuous system of drains, what are termed sumphs are employed to carry the sewage from the higher to the lower level. They are in fact hermetically closed gigantic cesspools, from which the sewage is pumped by steam or other power to the higher drain, which is to carry it away. Such a plan is only to be justified by any other being impracticable.

Under almost any circumstances, however, sewers will occasionally be subject to obstruction from the collection of matters which carelessness or sometimes love of mischief contributes to the sewage. Bits of rag, small stones, pieces of wood, broken crockery, and other substances, are often thrown down the pipes and, failing to stop there, are deposited on the invert of the main sewer and gradually accumulate a deposit around them. The drainage from sinks, kitchens, &c., often contains materials of like kind. To clear these away, the system of flushing has been employed, although sometimes its efficacy has been vigorously impeached. It simply consists in forcing a large body of water, sufficient to ensure a passage of great velocity, through the principal sewers, so as to

sweep every obstruction before it. This has been objected to, as tending to wash away the joints of brickwork and to weaken the junctions of pipe-drains. To a certain extent these effects must be admitted, but they are so limited as really not to amount to a valid objection. Brisbane is, generally speaking, well situated for such purposes, an ample supply being procurable from the river to cleanse all the sewers except those necessarily laid at a height which would secure a slope which would leave no chance of noxious accumulation.

It is obvious, however, that without some efficient and stringent regulations as to the construction of basements and proper water closets, the best system of sewerage possible would fail to realize its legitimate results. A cesspool should be prohibited, and basements for occupation below the sewer level should not be allowed. Unhealthy in themselves, they become doubly so in the event of any escape or leakage from the sewers. In London the law used to compel, and I believe still compels, the builder to provide efficient communication with the nearest sewer before permitting him to lay his ground-floor joists down. In many provincial towns the like regulation prevails. The public health has benefited, and no individual has been aggrieved by what in reality must tend most materially to his own comfort.

There is, however, one point in which it is apprehended that sewerage regulations here should differ from those at home, and that will arise from the very great difference in climate. The water-closet, however well fitted and arranged, should never be permitted within the house. No known arrangement of syphon and trap will prevent the faint odour which always exists in such a place, from becoming under our hot sun a positive nuisance. It is unnecessary to show, what the common sense of every member of the Institute will teach him, how easily and how conveniently the objectionable position could be avoided. The situation of these accessories may be made to exercise a material influence on the cost of the sewerage; since when placed uniformly in the rear of dwellings a branch sewer running under or near the dividing boundary would serve for two blocks of street buildings, without the disadvantage and expense of carrying the sewage pipes under the houses, or of breaking up the streets whenever the sewers required repair.

As respects the cost of the provision indicated in this paper, it would be impossible without an adequate contour survey, and without due regard to the present and future population, to say what expense would be involved by a general system of sewerage for Brisbane. For individuals the data are more easily ascertainable. The stoneware syphon pan can be bought in London for 7s. 6d. Stoneware pipes are stated at prices, varying with their size, at from 4d. to 4s. per lineal foot. Egg-shaped drains are sold at from 1s. 1d. to 3s. 6d. per lineal foot. With the cost of setting, of tank for water, and the common wire crank and valve apparatus, simple, but efficient closets are fitted up in London for 50s. Such a cost would be supplemented here by freight, importers' profit, and the higher price of labour. But as there seems to be abundant material in the neighbourhood of Brisbane for the manufacture of these pipes, as well as of the street channels before spoken of, the trade might be found advantageous amongst ourselves, could the inhabitants make up their minds to be benefited by its existence.

The financial or civic arrangements necessary for the provision of adequate sewerage are not properly the topics for a paper like this. Simply observing, therefore, that a distinct sewer rate is generally imposed for the purpose, either of paying the current cost or the interest of loans until the revenue becomes sufficient for the extinction of the principal, I leave the subject.

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ON THE DRAINAGE OF LAND.

A PAPER READ BEFORE THE MEMBERS OF THE PHILOSOPHICAL SOCIETY OF QUEENSLAND, AT BRISBANE, ON TUESDAY EVENING, APRIL 1ST, 1862, BY MR. W. PETTIGREW.

IN Great Britain no subject of late years has attracted more attention, or excited more discussion amongst those interested in the cultivation of the soil than the drainage of land. In Queensland the subject has yet to be discussed, and if this paper will be a means of drawing the attention of those most interested, viz., the landed proprietors, to its advantages, it will give me satisfaction.

The authors whom I have consulted are "Loudon's Encyclopædia of Agriculture," dated January, 1831; "British Husbandry," published under the superintendence of the Society for the diffusion of useful knowledge in 1834; and "A Cyclopædia of Agriculture," by John C. Morton, dated January, 1855. To this last work I am most indebted for the following pages.

Referring first to the history of drainage we find that its advantages seem to have been well known from the very earliest times. In Palestine the sides of some of the hills seem to have been carefully cultivated by having the soil held up by stone walls. The bottom of these walls acted the part of the drain by allowing the superfluous water to get away and the atmospheric air to get in.

That eminently practical people the Romans were well acquainted with the art of draining, and appear to have practised it to a great extent. All their writers on agriculture mention it, and some of them give very minute directions for the formation of drains, and the direction in which they should be carried. The materials which they employed for forming their drains were stones, branches of trees, and even straw. One of them mentions earthenware tubes, which appear to have been somewhat similar to our draining pipes, but they appear to have been used for conveying water from one place to another rather than for drainage.

In England various forms of ancient drains show that draining had been practised from a remote period. It was only, however, after the cessation of intestine commotions had rendered the enjoyments of the fruits of industry more secure that attention seems to have been systematically directed to the subject.

In a lecture delivered by Mr. Parkes before the Royal Agricultural Society at Newcastle in 1846 he quoted a very curious book written by a Captain Walter Bligh, the third edition of which appeared in 1652. Bligh not only gives directions for the systematic drainage of watered meadows, bogs, and marshy ground, but founds his rules upon principles which the latest experience and the most scientific researches have shown to be eminently correct.

The opinions and precepts of Captain Bligh seem, however, to have made but little progress, as the appearance of the country at the end of the last century and the early part of the present one abundantly testifies; so true it is that the mere enunciation of an improvement even when it appeals to self-interest does not necessarily insure its adoption.

In the latter part of the last century, a system of drainage was introduced by Mr. Elkington, and as about the same time the study of geology became more general, he brought its aid to the practical carrying out of extensive drainage, and in which he was very successful. He only, however, contemplated

carrying off springs by means of a few deep drains aided by auger-holes, and leaving unremedied the greater evils of rain-water flowing over the surface, or its stagnation in the soil. London gives an extensive description of the system, book III. chap. I. To remedy the latter evils many persons have devised various remedies, but they had only been partially carried out, owing either to their first expense or their want of durability. The first reference to tile draining is in "British Husbandry," published in 1834, at which time Mr. Smith, of Deanston, seems to have agitated the matter of having a thorough drainage of all arable and pasture lands in the country.

The system which Mr. Smith advocated consisted in having parallel drains in the furrows between the ridges, and from two to two and a-half feet deep; and to him is justly due the merit of reducing thorough drainage to a system. Of late years drains have been made deeper and further apart with great advantage.

There are few events in the history of draining which have had a more direct influence on its extension than the invention and improvement of tile-making machines, by means of which, and the improvements of draining tools in general, the cost of the operation has been lessened fifty per cent. within the last twenty-five years.

Results of Draining.—The beneficial effects which result from complete drainage of land may be classed under two heads—chemical and mechanical.

The Chemical Division is a copious one, and embraces more than our philosophy even dreamed of twenty-five years ago. It includes all that great class of phenomena relating to the improved fertilising powers of manures and alternatives; the improvement of climate, the rising of the temperature of the soil, the acceleration of the period of harvest, the decomposition of substances in the soil injurious to vegetation, the improvement in the nutritive value of herbage and other crops, and as a consequence of all these, improved races of animals, including man himself.

Mechanical Advantages—Let us consider the mechanical advantages. Every one at all acquainted with the conduct of agricultural operations, must be aware of the great difficulties which a wet state of the soil throws in the way of performing those operations with propriety, despatch, or economy of labour. The great object of all the operations of tillage is, along with the removal of weeds, to reduce the soil to a finely-divided state, through every part of which the fine, filamentary roots of plants may spread themselves, in order to obtain supplies, not only of moisture and air, but of those substances of which they are partly composed. The tempering of mortar or clay affords a very apt simile for any operations performed on wet land, and furnishes a true analogy as to the results.

It will, therefore, be evident that so far from furthering the object in view, ploughing, or other working of land when wet, will have the directly contrary effect of rendering it more stiff and close; and instead of producing a finely divided and porous state of the soil so indispensible to the healthy and vigorous growth of crops, will leave it, when dry, a hardened mass, in which useful plants will find it difficult to obtain even the most scanty subsistence.

The economical effects of drainage is evident by getting crops put safely in, especially green crops, the getting of them easily removed, the getting of better quality and larger quantity of all crops; it is found that in some instances the first crop has repaid all the expenses of drainage.

There are few cases in which the value of drainage is more strikingly illustrated than in the case of wet grass lands. The first effect of a judicious and thorough system of drainage on such lands is the speedy and sudden disappearance of rushes, and the coarse sub-aquatic grasses, and the substitution of a rich sward of sweeter and more nutritious herbage, which not only maintains a larger number of animals, but keeps them in better health and condition. There are no more effectual means for the extirpation of that most destructive disease—the rot in sheep—than by removing the superfluous water in the soil. So efficient has it been found, that on farms where rot annually destroyed large numbers of sheep, not a single instance of the disease had occurred since the land had been drained.

Drainage has a most important effect in preventing land from burning in dry seasons, and in preserving a certain degree of moisture in the soil. This arises wholly from the more perfect division of the soil, which takes place after the land is drained. Soil has the power of absorbing much moisture from the air, and this power is increased in proportion to the surface exposed.

This peculiarity of soils is thus referred to by Sir H. Davy:—"The power of the soil to absorb water by cohesive attraction depends in a great measure upon the state of division of its parts; the more divided they are the greater is their absorbing power." And again: "The power of soils to absorb water from air is much connected with fertility. When this power is great the plant is supplied with moisture in dry seasons, and the effect of evaporation in the day is counteracted by the absorption of aqueous vapour from the atmosphere, by the interior parts of the soil during the day, and by both the exterior and interior during the night."

"The stiff clays, approaching to pipe clays in their nature, which take up the greatest quantity of water when it is poured upon them in a fluid form, are not the soils which absorb most moisture from the atmosphere in dry

weather. They cake, and present only a small surface to the air; and the vegetation on them is generally burnt up as readily as on sands."

Liebig and others have shown that rain generally contains substances in the highest degree useful to plants; and that soils have the power of abstracting these substances from it in passing through them. It has been further shown by chemists that various injurious substances are washed out of the soil where a perfect system of drainage is in operation, or are so changed in their nature as to become innocuous.

Various experiments have shown that rain when percolating through the soil has a strong influence in raising the temperature of the latter, or equalising it to a greater depth. This may be termed a positive cause of increased temperature; but there is also a negative cause tending to the same end, namely, the decrease of evaporation from drained soils. By a natural law all bodies when undergoing expansion absorb a large amount of heat; thus, when a solid is changed into a fluid, or a fluid into a gas, heat is abstracted from all bodies in contact with them. A great amount of evaporation is constantly taking place from the surface of soil saturated with water, and the temperature of the soil is consequently lowered; whereas when the amount of moisture does not greatly exceed that for which the soil has a natural affinity, but little evaporation takes place, and that portion of the solar heat which would be dissipated in evaporating the water is applied to raising the temperature of the soil itself.

The Soil considered in reference to its power of absorbing and retaining Water.—All porous bodies have the power of attracting or absorbing liquids, in a greater or less degree, by virtue of a particular property called capillary attraction. Thus if a piece of lump sugar, or a damp sponge be placed in contact with water, however slightly, the water rapidly goes through every part of it. So it is with soils, as every one must have noticed in the familiar instance of a flower-pot rapidly sucking up water from the flat on which it stands.

Capillary attraction acts more rapidly in some soils than in others; thus, we find that in pure clay it exhibits its influence but slowly; in agricultural clays, into the composition of which some of the more porous earths enter, its action is more rapid; while gravel, sand, or peat speedily absorb as much water as they are capable of holding on being brought into contact with it.

This power of attraction also manifests itself on the surface of bodies, and may be called the attraction of adhesion. Soils, in common with all other bodies, possess this property, and possess it in a greater or less degree according to the aggregate which the particles of a given bulk present. Thus clay may, by means of kneading be made to contain a very large quantity of water. Sand and chalk, the particles of which are coarser, exert a less degree of adhesive attraction for water.

It has been found that sand was capable of holding 25 per cent., loamy soil 40 per cent., clay loam 50 per cent., and pure clay 70 per cent., of their own weights of water when the water was merely poured upon them in a dry state till it began to drop.

Clay soils are called impervious soils, because in their natural state they resist the passage of water through them. They are called retentive soils, because if water does gain access to them, their power of adhesion enables them to retain a large quantity of it for a great length of time. These properties have a very injurious effect on all agricultural operations, and their removal is one of the results which the scientific drainer seeks to effect. Let us consider how this is to be accomplished.

We have it in our own power to increase for a time the permeability of clay soils, by pulverizing them when dry, thereby separating their parts as to afford a ready passage to the water. Natural causes also have a like tendency. The summer droughts causes numerous cracks and fissures, which admit the rains to all parts of the soil. This, however, on undrained clay land is found to be an evil; for by means of it the rain is enabled to penetrate and saturate the soil to a considerable depth; while their great adhesive power retains it to an extent which reduces the soil to the state of a quagmire.

When clay is properly and thoroughly drained a new element is brought into operation by the constant supply of air to the soil. By its means the permeability is increased, while the adhesiveness, if not removed, is at least prevented from exercising any other than a beneficial influence. If we pour water on the earth in a flower pot, which has become somewhat dry, it refuses at first to absorb it. The water appears to rest on a plate of silver, which opposes its entrance into the soil. This shining appearance is caused by the air in the soil. After a little time the water sinks in, and generally passes through to the stand to be afterwards carried up by again capillary attraction. The same thing happens on a large scale on land which has been drained. The hole in the flower pot is represented by the drain, which permits the air to penetrate to all parts of the drained soil.

We have seen that soils vary in their power of capillary attraction, according as they are composed of one substance or another; but the same soils also vary according to the circumstances in which they are placed. The universal law of gravitation asserts its power, and places a limit on the height to which fluids can be raised in porous bodies by capillary attraction. If we fill a sponge with water, and place it on a table, we shall readily discover

that although it seems saturated with water in all its parts, yet that the quantity of water which produces saturation in the higher parts is less than that in the parts next the table.

When rain falls upon the surface of soils, which rest upon an impervious, or very slightly pervious substratum, it is gradually diffused through all the porous and absorbant portions by capillary attraction, assisted in clays by the cracks and fissures they contain. If the fall continues the soil becomes saturated, and the excess then forms pools, or makes its escape by flowing over the surface to any neighbouring water course.

When the rain ceases to fall those parts of the surface which are higher than the rest gradually become drier, because the water being no longer upon them the law of gravitation produces its natural results. Now, we cannot raise the soil, but we can, as we shall presently see, lower the impervious or saturated bed on which it rests, and so increase the depth of the porous soil.

If we cut a drain or trench into the subsoil we immediately disarrange the hydrostatic relations which exist in the neighbourhood in a greater or less degree according to the depth. The capillary force which retained the water in the soil to the height of a few inches, is no longer able to sustain it when the height is increased to feet; so a portion descends into the drain, leaving the upper part of the surface comparatively dry. Now the unequal pressure of different heights of water in the land, immediately compels the portion of soil next to that from which the water has been drawn to yield up a portion of its excess to it, obtaining in its turn a portion from that farther off, and so on through the whole mass of the surface soil; but as fast as it is supplied the drain draws it off, so that in a short time the level of the water in the whole mass is lowered. This is the action which is indicated by the term *drawing* which is so often applied to drains.

All soils too, but especially those containing clay, possess the property of expanding when wetted, and contracting when dried; so that after the drain has removed a portion of the water a considerable contraction takes place. But this is especially noticeable in a dry season. As the ends of a field cannot approach each other to suit the contraction, both soil and subsoil are torn asunder and divided into small portions by a network of cracks and fissures.

These phenomena are of the utmost consequence in draining land; indeed it may well be doubted, whether without such properties in the soil or subsoil, we could drain our clay lands at all. It is worthy of remark here, that as on stiff soils the cracking action is strongest, nature seemed to second the efforts of man, and compensates the want of porosity in clays by the more powerful development of a property which under skilful treatment renders them almost as easy to drain as the more porous soils.

The tendency of draining is to increase and guide the course of this cracking action. The main fissures all commence at the drain and spread it from in almost straight lines into the subsoil, forming so many minor drains or feeders all leading to the conduit. These main fissures have numerous small ones diverging from them, so that the whole mass of earth is divided and subdivided into the most minute portions. The main fissures are at first small, but gradually enlarges as the dryness increases, and at the same time lengthen out, so that when a dry season happens they may be traced the whole way between the drains.

When the fissures are once formed, the falling of loose earth into them, the roots of plants penetrating them, and the grooving action of the water which passes through them, prevents them from ever closing so perfectly as to hinder the passage of water; while each successive summer produces new fissures, till the whole body of the subsoil is pervaded by a perfect network of them, which gradually alters the very nature of both soil and subsoil; and in connection with judicious and liberal manuring has the effect of converting poor cold clays into something not very different from a good clay loam.

Of the depth of covered drains for drying the land through which they pass.—Such drains have a twofold office to perform. They have to to collect the water from the soil, and then to carry it off in a certain fixed course. They must therefore afford free access to the water at all points and at the same time, and prevent it from leaving them by any other way than by their own channels.

Modern agriculture has shown, that to have large crops we must have a deep soil. The soil is the great storehouse of the materials of which plants are composed, but these require a certain amount of preparation before they become fitting food for our crops. That preparation is effected by exposing them to the action of the elements through the operations of tillage. Plants have the peculiar property of being able to adapt themselves to almost any amount of food which may be presented to them. Take turnips for example; these will be found varying from the size of a pigeon's egg to that of a man's head, or even larger, according to the amount of food with which they have been supplied. It is therefore an object of the first importance that a large quantity of what chemists call the "inorganic" constituents of plants be constantly in course of preparation in a soil deeply stirred by the sub-soiler or trench-plough. Drains then must be put in so as not to be disturbed by the operations of sub-soiling, and that would require a depth of about thirty inches.

But the preservation of the structure of the drain is not the only thing to be considered; there is the equally important and far more difficult question: *What should be the depth of drains in reference to the results required of them?*

The first consideration to which we must address ourselves in fixing the depth of drains, is the depth of soil required to be laid dry. There is a limit to the depth of drained soil required for the purposes of cultivation, and any extra expenditure in drying soil at greater depths than will yield a return, must be regarded as waste. In England, cultivated plants seldom exceed two feet deep, but here, bananas and maize go considerably more, although how far I cannot say; I presume that they go at least three feet deep in drained soil. The bottom of the drain should be from a foot to eighteen inches below the roots of the plants, so that they shall not be injured by the water upheld by capillary attraction. So then from four to five feet would be suitable for our climate, although it is considered that from three to four feet is suitable for England.

In porous soils, drains may be deeper and farther apart, because the water will readily flow to them from all parts, and the greater the depth the more powerfully will the capillary attraction of the soil be neutralized. In clay soils again, the drain has not only to carry away the water, but to aid in maintaining the artificial porosity of the soil, by means of which the water is to gain admission to it. This it cannot effect if placed at a depth to which the shrinkage of the soil does not extend. The comparatively slight benefit derived in many cases from drains in clay during the first season after their formation, more especially if it has been a wet one, is sufficient confirmation of this view.

Frequency of the Drains.—The distances at which drains ought to be placed apart, is a subject of great importance, and one on which much difference of opinion exists. Mr. Smith, (late of Deanston), who may be taken as the representative of one class of drainers, contends that the drains should be placed at very short intervals. He says—"In laying off the drains, the first object for consideration is, the nature of the soil. If it consists of a strong, stiff "till," or a dead sandy clay, then the distance from drain to drain should not exceed from ten to fifteen feet; if of a ligher and more porous subsoil, a distance of from eighteen to twenty-four feet will be close enough; and if in very open sub-soils, forty feet distance may be sufficient." On the other hand, Mr. Parkes, who represents the deep and distant drain system, says—"It consists with my own practice at the present time, that drains are being executed at depths at from four to six feet, according to soil and outfall, and at distances varying from twenty-four to sixty-six feet; complete efficiency being the end studied, and the proof of such efficiency being, that after a due period given for bringing about drainage action in soils unused to it, the water should not stand higher, or much higher, in a hole dug in the middle between a pair of drains, than the level of those drains."

The distance apart, like the depth of the drains, must be governed by a variety of circumstances, all of which demand strict and careful investigation before proceeding to set off any system of drainage. The most important of these considerations is the nature of the subsoil, and the effects which the removal of stagnant water will produce upon it. In some soils a great degree of artificial porosity will be produced by draining; on these the drains may be further apart than on soils in which this cracking is less powerfully developed.

The subsoils upon which draining acts to a shorter distance than perhaps any other, are those clay subsoils containing a larger quantity of imbedded stones. The great portion of their mass, which consists of inexpansible materials, prevents the production of that artificial porosity which plays such an important part in the draining of the purer clays.

A scale of distances varying from eighteen to forty feet, will be found to suit almost any case that may occur, while it will not incur the charge of waste of means on the one hand, or inefficiency on the other. In my garden at South Brisbane the drains are sixteen and a-half feet apart, and four feet deep: but from what I have seen of them they would act perfectly well were they twenty-four feet apart, and four and a-half feet deep.

Then as to the direction of the drains, with reference to the declivity of the land. As the law of gravitation, when permitted to act by either natural or artificial porosity, is that which governs the descent of water into drains, so the chief object to be considered in laying out drains is to place them so that this principle will act most fully upon them.

In flat land, all the parts of the surface will be in the same relative position as to height above the drain in it. The main consideration will be the place of discharge and the main drains.

Where the slope or fall is very slight, the necessity for selecting the line in which it is greatest for the direction of the drains, in order to obtain a flow in them, will be admitted by all. This rule ought also to obtain in all cases of sloping land, no matter how steep the slope, because the line of the greatest fall is the only line in which a drain is relatively lower than the land on either side of it.

As to the material of which the drain is made nothing can come into competition with pipe tiles. They are the cheapest in first cost, and if properly made, and have a fine ringing sound when struck, they may last for ages. Their cost in England varies according to the price of coal. Two inch pipes are quoted at 15s. per thousand feet, but the price of the same here is 12s. per hundred feet, which is eight times dearer. The entire cost for making drains is quoted at 6½d. per rod for 3½ feet deep drains. Another instance is given where the entire cost for labour was 5½d. per rod, and this seems to be a fair average for drains 3½ feet deep.

Taking the average price of 1½ inch and 2 inch tiles at 12s., the cost of draining, exclusive of carriage of pipes, for 3½ feet drains will be 7⅝d. per rod, or the cost per acre for drains 18 feet apart will be £4 16s. 3d, and for those 24 feet apart, £3 12s. 2¼d. As, however, the price for labour here is, at least at this work, six times greater than in England, it will give an estimate of their probable cost here by multiplying these sums by seven. The price, then, for drains *four* feet deep and 18 feet apart might be about £34, and for 24 feet apart, £26 per acre.

These sums, when compared with what they are in Britain, are no doubt large, but when it is considered that land is selling at from £100 per acre and upwards, in and around Brisbane, and that it is next to impossible, if not impossible, altogether to cultivate it as a garden without being drained, these sums sink into insignificance when compared with the benefits to be derived from thorough drainage.

From that statement it will be evident that only land in and about the town will pay to be drained at present. Our agriculturists must only attempt to cultivate land that does not require draining, of which, I am glad to say, there is abundance of in the country for years to come. The lands about Brisbane which are thoroughly drained, so far as I know, are a paddock at Mr. George Raff's place, and part of one at Mr. Robert Cribb's place. Milton lands are only partially drained. I presume Mr. Skyring's garden is drained from the crops which it produces. In the town there are several gardens drained, but I will only refer to the following, viz., Mr. William Sim's, in Mary-street, nearly opposite the Queensland Club-house, and Mr. Henry Keid's, in Margaret street, as those in low ground; to Mr. J. Jeays, on the North Quay, as on a medium elevation, and to Mr. John Scott's, near to Mr. Bourne's house, as on high ground. In these gardens the plants look healthy.

I will close this paper by referring to one instance, viz., to the allotment adjoining Capt. Coley's store, in which the proprietor was at a great expense in what some people might call trenching it. It consisted in digging down the soil and covering it with the subsoil. It was planted with sorghum, but I do not think the produce covered one-tenth of the expense. As a consequence, the proprietor got disgusted with his operations, and it now lies a waste. Had he been at half the expense in draining it, the issne would have been quite different, for, if drained and cultivated a short time, it would make a splendid garden.

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THE INFLUENCE OF CLIMATE

ON OUR DOMESTIC ARCHITECTURE.

PAPER READ BY MR. W. COOTE, AT THE MONTHLY MEETING OF THE QUEENSLAND PHILOSOPHICAL SOCIETY, AT BRISBANE, NOVEMBER 4TH, 1862.

I DO not know why so little attention is paid in these colonies to the influence which climate should exert in modifying the architectural styles we import from the old world. We alter our dress to suit the requirements of the season, varying it in material, and often in shape, to suit the exigencies imposed by a burning sun. But in building our houses, and modelling our public buildings, we seem to adopt as a primary question the motto which I remember to have seen on a pointed design for a club-house by an eminent modern architect—" Why work we not as our forefathers wrought," and we adopt it with reference merely to the manner of their working, and not to the spirit by which they were guided. There is thus seldom anything racy of the soil in the artistic spirit we display —even in our most imposing structures. As to the dwellings in which we live, it is surely no libel to say that in nine cases out of ten taste and comfort are equally set at defiance. Yet the home in which the greater part of our existence is spent would repay the attention paid to rendering it pleasant as well as convenient. If anyone doubts this who is accustomed to the mere pleasures of cleanliness and space, let him ask what his sensations would be if suddenly transferred to a low dark wooden shanty such as in too many, if not in most, instances form the covering places of our working population. The truth is that there is a gradation of feeling in these matters. He who is accustomed to the highest species of enjoyment is restless until it is attained. The man who can get nothing but dirt and darkness becomes gradually habituated to them as part of the conditions of existence. He can be none the better for this species of training, the probability is that he may be worse. If there is degradation in such a progress we may fairly enough infer that the opposite direction tends to elevation. And the history of civilisation enforces the inference. It may therefore be useful, and in accordance with the objects of this society, if we attempt the inquiry, what influence climatic considerations should have on the arrangement and style of our domestic habitations.

In a cold country there is danger in very large rooms unless adequately warmed and ventilated; in a hot one the larger they are the better, always supposing the light not to be too strong, and that due precaution be taken to keep the direct rays of the sun from the walls and ceilings of the apartment. Wherever these two essentials are neglected, the requirements of the climate are neglected, and proportionate discomfort will follow. Hence it follows that with us space and shade are primary considerations. Again in a cold country the exclusion of the external atmosphere is a matter of the greatest necessity. With us, its ready access, without draughts, is equally essential, protection from the sun being secured. Such a condition points to roomy and broad verandahs, which in classic structures become stately colonnades. The ventilation question is one of comparative ease under such conditions. A house properly arranged with regard to these main principles will require few aids in that respect.

If we examine the favourite styles adopted at home for house architecture, we shall, I believe, find that where structures of moderate size are to be built, either a modification of the domestic Gothic or Elizabethan is employed, or a

species of Italian, or rather Venetian, in which, however the details only thinly disguise the main forms characteristic of the former two. In every case the sun is courted. The windows in the domestic styles are large where it is possible the characteristic mullion and transom being omitted, and the line of the prominent and lofty gabled roof is broken by dormers which admit light to rooms formed in its space.

Even in the attempts at Italian villas, not a little of this spirit is displayed, what is termed the mansard roof, affording a back ground for a like display. In both cases economy may not less than taste, form a motive for the employment of such features. As to verandahs, except for porches, or under very peculiar circumstances, they are seldom employed. In fact they would be a nuisance. Of late years, much effort has been made to avail of the productions of localities in giving local character to this kind of building, and the infinite variety of manner in which common and colored bricks have been used, show both the industry of the rising school of architects and the direction to which their labors tend—that to which our enquiries should also lead—the improvement of the architecture of dwellings, and their identification with the country and climate in which they are built.

But looking to our original conditions, we shall find that these distinctive features are not only not required here, but are positively opposed to our local circumstances. Large windows are large discomforts. The glare of our summer sun renders shade not merely a luxury, but a necessity. Rooms in a roof are but reservoirs of heated air,—and verandahs are indispensable. For let it be remembered that with us it is not a hot atmosphere, but a hot sun which is so hard to bear; shade and coolness are almost synonymous terms. Hence whatever may be the style or modifications of style in the details we adopt, the distinctive main features of the home architecture are not consonant with our principal object, and therefore not with correct principle. Undoubtedly the Venetian Italian, with little modification, would form a graceful and admirable style for our purposes; but then it is costly, and involves a kind of labor which we have not. It is with the employment of ordinary materials for common uses that we have to deal, and upon them this paper professes to treat.

When we lay down as a fundamental rule that space is a primary condition, we do so because without it we cannot secure that easy circulation of air which, with us, is a necessity. Every room should, if possible, have two of its sides external and easy of access to the atmosphere; the huddling of apartments on the English model, in a square box form, is the worst possible arrangement that can be adopted, carried to its climax in that detestable terrace system which ought to be forbidden by municipal enactment. For comfort and equally for health in this climate, every dwelling-house should be detatched. How far the present system of cutting land into trumpery little allotments will obstruct proper arrangements in house building in this respect, it may be hard to say. We may indeed find consolation in the knowledge that its prevalence must be limited by local causes to a very short duration.

Spaciousness of site being attainable—and it seems absurd that in this country of all others, such a requisite should not be in the reach of every one—we next come to size of rooms. A distinction must here be drawn between living rooms and bedrooms,—the former being occupied intermittently, the latter continuously during the hours of sleep. It follows that if regard be had to purity of atmosphere, bedrooms should be larger in proportion to the number of occupants than sitting-rooms. Following the best known authorities on this subject, it would seem that a bedroom for a single occupant should not be of less size than to contain 1200 cubic feet of air. A room 12 feet long by 10 broad, and 10 feet high, would fulfil such a condition. A living room, used in the ordinary manner by four persons, should not contain less than 2400 cubic feet. A room 18 feet by 13 wide, and 10 feet high, would be not ungraceful in proportion, and satisfactory as regards space. A very moderate deduction from such sizes is a very moderate deduction from the means of preserving health. An increase on these sizes would tend to increase of enjoyment.

The size of apartments being graduated by the numbers expected to occupy them, I am afraid that little prospective economy may be anticipated by the fathers of large families from the application of the principles herein laid down; but it may be replied that real economy would be better consulted by healthy large rooms than by close and badly arranged apartments—consequent ill health, doctors, and doctors' bills. And after all, the additional cost involved could be much smaller than is generally supposed. In another paper I propose supplying some details on this point which may perhaps relieve the scruples of those who rather than not build at all, would build badly, and repent their haste when it was too late to mend.

But for the present to return to my subject; —next to space comes disposition, of which the first point is the aspect of the several rooms to the points of the compass. Generally speaking it is desirable that bedrooms should front towards the east. The morning sun is an advantage to all but the sluggard; and as the direct sun's rays cease to beat at an early period of the day upon rooms having such an aspect, there is time for the apartment to cool by night time. The luxury in summer time of escaping from the heated atmosphere of an ordinary living room to the pure cool air of a bedroom of

the size and aspect mentioned, is one which ought to be more familiar to us than it is. Those who experience it know how intense a feeling of relief is thus caused. With respect to common dining rooms, it may be questioned whether a southern aspect is not desirable in such a position. There is less of that direct sun light which in this climate, and at most periods of the year, is so disagreeable. In houses where a separate breakfast room is admissible there is no objection to its facing the west. You get the glow of the morning sun on the view before your windows, and feel the agreeable benefit of reflected light yourself. All who appreciate gazing upon the mid-day landscape from the green cover of some spreading and shady tree will fully understand the feeling here appealed to. The source of enjoyment in both cases springs from the like cause. With respect to drawing rooms as they seem mostly built and fitted up for exhibition, and when used, are so principally in the evening, their aspect is not of so much importance. The great point with them is to keep every kind of smell emanating from culinary and eating operations out of reach. A northerly aspect is not objectionable, since a room facing in that direction would get half shade for some period before sunset. But whatever may be the value of aspect, no arrangement can be considered perfect when any one room perforce becomes a vestibule to another. I do not, except in the case of bedrooms, dispute the value of so placing apartments that they can be thrown into one commodious and spacious series, but the annoyance that may be frequent from the only entrance into a bedroom being through a common living room must be obvious to every housekeeper. The decencies as well as the courtesies of life enforce retirement for every sleeping room, and this should never be neglected.

As regards the kitchen, it seems that a great deal of positive wretchedness is sometimes caused by its defective arrangement. In some houses it is so placed as to distribute its odorous vapour by means of its connection with the entrance hall throughout every room, a contribution in the case of the chimney smoking, more powerful than pleasant. It is always a hot room, and often what is termed a close, *i.e.*, badly ventilated one; and frequently no attention whatever is paid to the provision of drainage—as essential to a good kitchen as to any other convenience of a dwelling house. Scanty shelving or none at all contribute to the destruction of crockery and the household peace. Those primitive camp ovens exercise the privilege of covering the hearth, and a great deal more besides, with dirt and dust; and not the least disservice rendered by a dirty kitchen, is that dirty servants attend in its company as naturally as smoke upon fire.

The shape of a kitchen should be rectangular, and the chimney if possible should project externally, and not break into the leading lines of the room. If this be done no superfluous heating surface is presented within the the room, and the housewife's abhorence, the holes and corners caused by re-entering angles are dispensed with. In these days, when the advertising sheets of every home journal claims attention for multiplied varieties of cooking stoves, it is very poor economy in every way not to furnish a kitchen fireplace with one. A good stove saves time, fuel, dirt, and temper—all articles of great importance to a servant, and indirectly to the household in which she is. Then a well-arranged dresser is of almost equal value; the pots and pans do not spread over the floor, but find their appropriate black board; the drawers and the shelves keep the crockery and glass in ordinary use out of harms way and readily accessible. A few good sized hooks on the walls are also of use, but the sink so handy and so nice when well kept in an English kitchen, would here stand great chance of being an abomination. It must be so unless plentifully supplied with pure water. I think that in the kitchen of Mr. Robert Cribb, at Dunmore, the pump is within it, that pump having plenty of water frum the well over which it stands. In such a case a housemaid's sink might be desirable, not otherwise.

A kitchen should not be small if it is to serve its proper purpose in our domestic arrangements; space is economy in cooking and servants' work, especially in these days of crinolines, when without "ample verge and room enough," every sweep of those multitudinous folds threatens plates and dishes with dire destruction, and fire-irons with downfall and horrid clang. It should have special attention paid to its ventilation; and for that purpose a range of louvre board apertures closing at will at a height not greater than seven feet from the floor is desirable. A necessary assistant to these would be an Arnott's valve in an air flue attached to the chimney stack. Then the whole apartment should be isolated as much as possible, although a kitchen with no covered approach must be productive of annoyance, especially in rainy weather. As to the flooring, the less of wood about it the better, unless stone cannot be procured; then stout hardwood planking is better than soft badly burned brick. A ceiling is not indispensable; on the contrary it may be found desirable to leave a kitchen open to the roof.

There are minor appendages such as a scullery, or place for washing dirty vessels, and a laundry. A very simple structure will serve the purpose of either, but the latter seems an essential accessory to any house. Where washing is done in a kitchen, there is a controversy as long as it lasts between the diverse necessities of the house in which both suffer; and the steam from washing tubs does not furnish a satisfactory condiment to either roast

or boiled. But to both laundry and scullery there should be ample drainage. If a garden be attached to the house, the drains from these places might profitably communicate with a tank, whence the contents could be drawn as occasion required. They would help to enrich as well as to moisten the soil.

I may be thought to have dwelt too largely on this last portion of the subject, but let us consider that fully half our time is occupied in providing for eating and drinking, and surely it is not undesirable that the place in which what is acquired at so much expenditure is prepared, should be constructed on the best principles for economizing time, convenience, comfort—and therefore health. A badly cooked meal is a preparation to indigestion, and it will seldom be found that a dirty ill-provided kitchen sends forth any other than bad or slovenly cookery.

So much for individual rooms. Let it be added that in all cases where practicable, fire-places should be considered essential. There is no more mischievous error than to suppose that the heat of this climate renders them unnecessary; on the contrary, as a means of ensuring ventilation they are of the greatest use.

I now come to the best form of disposition for rooms in an ordinary house. We may learn something if we look to those arrangements which the experience of ages has resulted in, in analogous climates.

If we take Algiers—a kindred climate—the general form will be found that of rooms grouped round an open court.

If we take Rome, we shall find the open court an almost invariable accompaniment to her best palaces and dwellings.

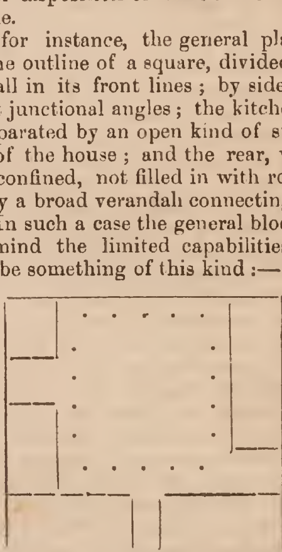
If we consult the architecture of Spain under a similar temperature, we find the like principal feature predominates in the dwellings.

If we look back to the plans which were adopted by the principal nations of antiquity, whose climates approach our own, we shall be struck by the general accordance of plan in this respect. In Pompeii once, as in Naples now, in ancient Nineveh, and the modern Teheran the open air is courted by similar means—the open court is the leading feature. We shall scarcely find any arrangement in architecture which, through all the mutations of style and nationalities, has the unbroken practice of over twenty to thirty centuries to sanction its adoption.

If we try to discover the reasons which in so many cases led such different nations, opposed in religion, in manners, in all that can confer the distinctive characteristics in communities to adopt one common feature in their architecture, it may possibly be proved by referring to the following considerations:—In the first place it gives the owner, to a great extent, his choice in aspect for the principal dwelling rooms. In the second place it secures the utmost circulation of air that can be obtained in a dwelling house. In the third place it affords the greatest facility for living as it were outside walls with almost as much privacy as is obtainable within them. And lastly, it both multiplies shade, and, properly managed, diversifies scenery. When the view is extensive from the house there is no necessity for excluding it from outside the court, which may even be made to form the framework as it were to portions of a picture. Where no view is to be got, as in most suburban houses, then the interior of such a court may always be rendered refreshing to the eye, cool, shady, and airy, a pleasant variety to the rooms which surround it, and not the least adjunct to the ornamentation as well as to the comfort of the whole dwelling.

On a site which admits of a frontage of fifty or sixty feet, such an arrangement is always practicable. And when, as in some instances even here, adjoining buildings block up both sides of the allotment, it is most advantageous. It is not intended in this paper to show the details of such a plan and the situation of every room—that falls within the province of any architect who understands the subject—and the varieties of circumstances are so great that one model could not possibly be laid down as applicable to all. It would be nothing to be thankful for if it could; for out of diversity of demands has arisen some of the most charming combinations of which architecture is capable. It is only necessary to point out one or two methods of general disposition of which the system is susceptible.

Thus, for instance, the general plan might present the outline of a square, divided by the central hall in its front lines; by side passages at its first junctional angles; the kitchen at the corner separated by an open kind of store from the rest of the house; and the rear, where the site was confined, not filled in with rooms, but crossed by a broad verandah connecting the two wings. In such a case the general block—bearing in mind the limited capabilities of type—would be something of this kind:—



The ordinary dwelling rooms might occupy the front, the bedrooms the sides, and the kitchen, with its attendant conveniences, the left hand angle of the court.

In a house of larger pretensions a different and more imposing arrangement of the rooms

might be devised : but these differences will be so obvious to you, that it is unnecessary to dwell upon them. There is, however, one point on which it may not be amiss to enlarge—and that is the facility which such a disposition of plan affords for the ample accommodation of a moderate family without rendering a resort necessary to more than the ground story for the purpose. Such a facility considering the material of which most of our dwelling houses are now and are likely for a long time to be built is most valuable. There is less danger of loss of life in the event of fire—less annoyance likely to arise from defective building—and much greater scope for shade and space at much less comparative cost. Add to this that unless staircases are wide and well planned, they are, in a hot climate, always more or less a nuisance. It has been urged that upper rooms secure the coolness of the lower ones, but admitting this by no means inevitable consequence then the upper ones are left heated. Now it you avoid rooms in the roof you have a considerable space above the ceiling and you can secure a current of air always passing through it, which in the case of dwelling apartments is impossible.

I have spoken of verandahs. For shade and for shelter a width of seven feet is the practical minimum. Of course, if the wall to be sheltered is lofty and the verandah high also, then the width must increase. It should never be narrower than will admit of keeping the walls always in shade when the sun's rays fall at an angle of forty-five degrees.

With respect to the materials for an ordinary dwelling, it is not to be doubted that stone will come first, good brick second, timber thirdly, and common or inferior brick last of all. But there are methods by which very common material may be made to serve all the useful purposes of the more costly. Architectural effect—properly so called, for I do not mean mere prettinesses—must be left for the present out of the question.

The usual method of building a timber house is by an arrangement of common quartering of the smallest possible scantling not very scientifically braced, and either boarded on both sides or boarded outside and plastered within. There is little air space between the external and internal linings, and the weakness of the individual pieces to resist the warping effect of our scorching sun is far from provided against by the framing. An equal or less quantity of timber properly disposed would produce a far better effect and be more useful in securing an equable temperature within the dwelling. In arrangements of this kind some of the half-timbered houses of Essex and Norfolk supply admirable examples—I mean in a constructive as distinguished from an architectural point of view. In these houses the greatest care was bestowed in providing principal bearing posts and heads and cills of large scantling, so as to admit of the interspaces being filled in with light material with the least possible detriment to the general fabric. In some houses in these as well as in other English counties, almost the whole external space between the angle posts of of a room is filled in with windows. In this colony we do not want the large window; but the system of framing is worthy of consideration. In a room wall presenting a frontage of 15 feet, two angle posts and two intermediate ones would be wanted ; between these last the window would be fixed. Horizontal pieces from post to post at intervals of two feet six would serve to carry the vertical grooved and tongued boards which would line the outside walls. For the inside a half brick wall bonded with horizontal ties nailed to these posts would admit of internal plastering to those who like that method of finishing (which indeed where paper is to be employed is almost indispensable and would besides present a non-conducting material to neutralise an external heated atmosphere. Or were brick work desired to vary the external aspect, the heavy timber main supports might be allowed to appear, and the spans between filled in with an external and internal half brick wall connected by header courses of longer bricks at the proper intervals. Such a wall would be as great a non-conductor of heat as a coursed rubble stone wall two feet thick, and very much cheaper, and superior in effect. You can get no art out of a plain rubble wall, but the timber and brick afford almost infinite variety of combination. In the internal divisions, the principal supports being of large dimensions you could have brick, or plastering, or timber lining, as you chose. I do not enter into details, although they are easily supplied, lest it be supposed that this paper is too exclusively professional.

The great charm of this style is the facility it affords for colour—and to the tropical eye colour is a banquet which, not to have, is to miss half the enjoyments of life that sight can give. In those calm and austere temples which fling their shadows from the summits of the Æginetan steeps and compelled the admiration of the philosophic Greek—in the ponderous courts of Egyptian mass and grandeur—in the complicated decoration of those palaces of the Assyrian Kings which Layard has laid open to the world—in the dwellings and shops even of Pompeïi, not less than in the Saracenic courts of the Alhambra—wherever an unclouded sky and unfailing sun has made a clear and brilliant atmosphere the commonest element in material enjoyment, there colour has been invariably sought, to modify light, to relieve the eye, and to give the luxury of its variety to lighten monotony of form. Nature itself teaches us the same lesson. We ordinarily speak of the gorgeousness of tropical colours as shown in birds, in foliage, in flowers ; and living within a semi-tropical

climate, we bring our greys, and drabs, and browns, and settle down into the veriest Quakerism of art, forgetting that man thus is in contradiction to everything around him, and foregoing a delight which all else that he looks upon invites him to enjoy.

It is not necessary to be gaudy in the application of colour, or otherwise a barber's pole would be a choice object of art. But let us conceive what might be done with a verandahed wall of the kind I have mentioned. The brick—I take it for economy's sake—would be the common dull red and grey, which might be in alternate layers. The hardwood framing would, to a certain extent, contrast with and lighten this. But if you want the perfection of obtainable effect you must have a green. Now, green as a mass in colour, is not always desirable, and therefore don't employ a painter. Plant by your verandah-posts such creepers as, with broad green leaves, will give you flowers of a violet or purple hue, and you may get an effect of colour such as the best flower-painter might envy. There is no kind of surface colour can give you that choice variety of tint which the light and shade playing on leaves afford. Then put a thin line of vermilion on the chamfered edges of your upright wall-posts—not verandah-posts—and of the window and door frames, and the little common corridor will glow with life. You need not put little moulded caps on the verandah-post. You need no architraves to your doors and windows. The mere supports and frames supply their place. Let everything be as plain and simple in form as the greatest utilitarian could wish, and still you may have a front that it will be a constant pleasure to live within. And to live pleasantly is not a mean object to set before ourselves.

I am not unaware of the value of the floor in such an arrangement. For coolness as well as effect we may have recourse to the black and red tiles which are used so generally at home, and might be cheaply and easily made here. The variety of patterns which may be formed is almost infinite. Nor is it necessary to build thick walls or lay an expensive foundation. The simple constructive system employed by Messrs. Fox and Barrett in their fire-proof flooring—adopted indeed from the ordinary French plan—is fully adequate to all the requirements of such a pavement. It is scarcely necessary to point to the superior coolness and comfort of this kind of flooring over one of wood in verandahs, entrance halls, and similar situations.

Not the least important matter in house building is the roof. In a climate like ours the material to be employed in the outer covering is a matter of little difficulty. The cost of slates renders their use expensive, and practically leaves us only a choice between tiles and shingles. I hardly think there has been the taste shown in the manufacture of the former that might have been. A flattish flanged-like tile has been employed at home which presents a very satisfactory effect, even when used in large masses, and might be readily made here. It would admit of some variety of colour, for a huge surface of dull or staring red is not desirable. On the contrary, the roof might be broken up by diagonal and interlaying lines of a darker colour, greatly to its advantage. The common tiles now in use exhibit great superiority over shingles in ensuring greater coolness and a sweeter and cleaner supply of water from the roof.

We will come inside the house. Let us suppose the floor to have been laid with grooved and tongued boards set vertically, and the ceilings of the same material. This is unpromising enough, but still something may be done. You must have a skirting—let that be of cedar. You must have a mantle-piece—let that be of cedar too. Run a small moulding of cedar at the junction of wall of ceiling. And now call in the painter to aid you—sparingly, however,—for our woods require no concealment; not even the common Moreton Bay pine.

Of course you have had the ledges of your lining-boards not only grooved and tongued, but beaded, since a round form best conceals irregularity of junction. These beads are small. If you desire liveliness run a vermillion or a full green line on them. They will give space to your room. If a graver tone be desired, a neat chocolate brown is well, and will connect the colour of the cedar and pine better. Enliven your cornice and your door architraves, in either case with the bright red, but most sparingly. If you can afford a thin line of gold on your cornices, do so. Then lay on three coats of good, pure, clear varnish, and your room, dressed in nature's own materials, will light up into life and reflect gladness from every wall. And mind, here you have only the commonest material used in the most economical manner.

I shall not weary your patience by detailing any more of the thousand and one modes in which our beautiful woods might be made with trifling aid and at moderate cost, either in themselves or in combination with plastering or even paper on strained canvass, to give life and light to the interior of our dwellings. Many such methods will occur to all of you. In this paper it is only attempted, however feebly, to point the way. And I may say the same as to external decoration, in which woodwork may be as effectively employed as internally. It would not, however, be well to close this paper without some reference to two very important matters—the fireplaces and the interior court.

I have said that the interior court need not be closed in its rear otherwise than by a continuation of the verandah running round the other

three sides. The observations I have before made, as to the treatment of that verandah, will so far as the openness of the cross one will allow, apply to its finishing. But the space, or what some would term the yard, enclosed within the court, may become a dull monotonous surface of brown gravel, or present that wearisome geometry of pebbles in which some tastes find relief. Far preferable is it to lay that space out in one single bed of covering flowers. Any of the ground-creepers—especially the verbena—will afford green leaves, and scarlet, and lilac, and white, and almost every variety of colour, from which may spring the rose in its infinite variety; or what other flower the eye may most like to rest on. I remember reading some time back a traveller's ecstatic description of such an interior as I have mentioned. It was in Algiers. He was tired with the heat and choked with the dust; when, passing through a gateway, he found himself suddenly in the cool delicious shade of a small quadrangular verandahed space, within which a scarlet blossomed tree lighted up the centre, and gave that pleasure to the eye which the gurgling of a small fountain by it afforded to the ear. It was worth while being hot and dusty to feel the relief of such a scene; but I fear that until Mr. Alderman Jeays succeeds in bringing the waters of the upper Brisbane to our good city, there is little chance of fountains here.

Returning to the fireplace, it is singular to me how much we run on in the old groove, sticking to the monotonous chimney breast—the low square opening—the whitened brick within, like a white spot in the centre of the room—or the black fronted register to throw a gloom over it. Why not line the sides and back with some of those rich encaustic tiles which you can get from home for about 6d a piece now; and thus give variety and life even to this unpromising portion of the domestic economy. The moveable grate, or, for wood, fairly designed iron dogs, will serve all the purposes that your register stove could, and look far more lively and cool. We have a sense of some deficiency about this part of the house, or why do young ladies cut coloured paper into strips and make fantastic and inartistic lumps of all sorts and sizes to fill in grates and nail to chimney backs. If the want is felt of colour and decoration, why not combine it with the thing itself. I recollect seeing a very charming effect produced once in a library by turning the flue to the side of the chimney breast and inserting a window in the space over the fireplace. As it happened, the view over which the window looked was one rarely equalled in England; and that might have had some effect in heightening the satisfaction one felt at this mode of treatment. The hint afforded, however, might be turned to account in many ways.

I fear you will be fatigued with this long and rather discursive paper, and I therefore bring it to a close. Let us recall briefly the whole basis of the principles laid down. Space, shade, and adaptation of the material around us to the wants we feel. I am satisfied that an earnest investigating course of action on the part of our artists and architects would lead to a very different style of dwelling to any that we have yet seen. I do not say we could rival anew the glories of ancient Greece, but we might do this—we might make our architecture as characteristic of our time and locality as was done there. Until this is achieved there will be much loss of comfort—of enjoyment—even of intellectual progress. When we begin to apply a true artistic analogy to the construction of our own homes, we may hope to see public edifices worth looking at without a slavish copyism from the palaces and churches of the old world; but without that beginning such a hope were the vainest of all delusions. We cannot commence the process of improvement too soon.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

ANNUAL MEETING HELD ON TUESDAY, DECEMBER 2, 1862.

(From the *Queensland Guardian*, December 4, 1862.)

THE annual meeting of the Queensland Philosophical Society was held on Tuesday evening last, at the Brisbane Hospital, Mr. SYLVESTER DIGGLES in the chair.

The minutes of the previous meeting (held on the 4th ultimo) having been read and confirmed,

Dr. F. J. BARTON rose, and said he had great pleasure in welcoming back one of the original members of the Society, the Rev. George Wight, whom he begged to introduce to the members present.

The Rev. GEORGE WIGHT said that he felt an equal pleasure in once more attending the Society's meetings, and should have much regretted not receiving an invitation to attend the present meeting, as he had always felt a warm interest in the Society.

ACKNOWLEDGMENTS.

Dr. BARTON informed the meeting that he had written to Mr. Waller (of Brisbane), acknowledging his donation to the Society; and also to Mr. Wilson (of Adelaide), informing him that he had been admitted a corresponding member of the Society.

ENTOMOLOGICAL COLLECTION.

The CHAIRMAN announced that a gentleman residing in Sydney (Mr. Salting), who is in possession of one of the largest and best private collections of insects in the colonies—containing upwards of 2000 specimens—had offered to dispose of the same to the Society for £18, which he (the Chairman) considered a very reasonable price for so valuable a collection. The Rev. W. B. Clarke, of Sydney, had been solicited to examine and report on the specimens, with a view to their purchase on behalf of the Society. He (the Chairman) understood that there were some blanks in the collection, but these he should be happy to fill up from the specimens in his own possession.

The Rev. GEORGE WIGHT approved of the purchase of the collection in question, if favourably spoken of by so high an authority as the Rev. Mr. Clarke, and said he considered the Chairman's offer to improve and perfect the collection in the manner proposed by him, should be fully recognised by the Society.

The Rev. R. CREYKE said that he had written to the Rev. Mr. Clarke, and expected an answer to his communication by the next mail.

RECEPTION OF LANDSBOROUGH, THE EXPLORER

The CHAIRMAN brought under the notice of the meeting the subject of a public recognition of the services of Mr. W. S. Landsborough, the explorer. He quite concurred with the opinion expressed in that day's *Guardian*, which, in announcing the gratifying intelligence that this eminent explorer was about to revisit Queensland, the scene of his successful and triumphant exertions on behalf of science and civilisation, had at the same time thrown out a suggestion that the Philosophical Society should take the lead in an appropriate recognition of Mr. Landsborough's talents, and of the eminent services he had rendered to this colony in particular. But the question was—how was it to be done? and, what kind of reception was to be offered to him on his arrival? It was, he thought, a fit subject for discussion that evening. For his own part he felt rather at a loss to make even a suggestion, and he would be

glad to hear the opinions of the members present. In his opinion it would be better if the reception agreed to be given came through Mr. Gregory, who to him seemed the person most fit to take a prominent part in a matter of this kind.

Mr. W. Coote was of opinion that the Society was hardly strong enough to undertake an affair of this kind. Of course it would not be right on their part to pass over such an event in silence; but they must act with care and prudence lest their weakness should become conspicuous. He felt sure that Mr. Landsborough would meet with a cordial welcome.

The Chairman suggested that a written address should be delivered on the occasion, and Mr. Landsborough be invited to become a corresponding member of the Society.

The Rev. Mr. Wight enquired when Mr. Landsborough was expected?

A Member: By the next steamer.

The Rev. Mr. Wight: The necessary arrangements would cause some delay; and he scarcely thought they had sufficient time in that case to get up a demonstration that would be at once appropriate and effective. It seemed to him that the initiative should unquestionably be taken by this Society; but he did not think it would be wise for the Society to make a demonstration alone. He thought if other associations existed in the city—being to a certain extent a new-comer and a stranger, he was not aware of any, although there might be others—that could legitimately join with the Philosophical Society in this movement, they should be invited to co-operate. A committee should be formed on behalf of the associations or public bodies, and a general reception given to Mr. Landsborough—not a partial one, as would be the case were they alone to act in the matter. Certainly none could with greater propriety take the lead than a Society of this kind. He was speaking merely on the abstract question, as he had not the honor of knowing the gentleman who had gained even fame during his absence from the colony. They were bound to recognise Mr. Landsborough, but he thought it should be done through Mr. Gregory.

Mr. E. Mac Donnell had little doubt that Mr. Gregory would, from the position he held, take a prominent part in the proposed reception; and none knew better than he the hardships and difficulties that had been encountered by Mr. Landsborough.

Mr. Coote regretted that the Society was not in a position to present Mr. Landsborough with a piece of plate (as had been done in Melbourne), in token of their recognition of his services.

The Rev. Mr. Wight said all classes would no doubt unite in giving Mr. Landsborough a hearty reception, and it would be very proper that the lead should be taken in the matter by Mr. Gregory, who had for a long time been engaged in exploring the country, and who was also, he understood, a member of the Society.

Mr. Coote would mention that in Melbourne the address that had been presented to Mr. Landsborough was read by Sir Henry Barkly.

The Rev. Mr. Creyke thought that Sir George Bowen would feel a pleasure in doing the same when Mr. Landsborough arrived in Queensland.

The Rev. Mr. Wight would suggest that perhaps the most interesting way of recognising Mr. Landsborough's services would be to invite him to a meeting of the Society, and there present him with an address (hear).

Mr. Coote said in such case the Society should require their President to take the lead.

Dr. Barton thought the best course to pursue would be, as suggested by a previous speaker, to appoint a Committee (hear).

Mr. Coote: Then let this meeting request the Council to act, and suggest the course of action. He thought the Acclimatization Society might fairly be invited to co-operate, as being the only other Society established for scientific purposes in the colony (hear, hear).

The Rev. Mr. Bliss, and several other members of the Society, here expressed themselves as approving of this suggestion.

The following resolution—proposed by Mr. Winder, and seconded by Mr. MacDonnell—was then put and carried:—"Resolved by this meeting, that the Council be requested to communicate with such public bodies and individuals as they shall see fit, for the purpose of inviting them to co-operate in a public expression of their sense of Mr. Landsborough's services in the cause of science and civilisation."

The Chairman reminded the members that if anything was really intended to be done, there was no time to be lost, as a special meeting of the Acclimatization Society might have to be called to take the matter into consideration.

Dr. Barton suggested that another meeting of the members of the Council be called for next Thursday (to-day) to make the necessary arrangements.

Mr. Coote thought this scarcely necessary. There was no time for it.

Mr. Wight would remind the Council, or the Committee of such Society, that they must be prepared to communicate with Mr. Landsborough immediately upon his arrival.

Dr. Barton thought they should first wait upon His Excellency and ascertain whether he would read an address on the occasion. He would then call a meeting of the Council; and His Excellency the Governor, as well as Mr. Bernays, the Hon. Secretary of the Acclimatisation Society, could be invited to attend.

The Chairman suggested that His Worship the Mayor should also be invited to be present.

Mr. Wight said a second meeting seemed necessary in order to make the general arrangements to be carried out on the occasion, but it should be convened on the earliest possible day.

The Rev. Mr. Bliss was in favour of a meeting of the joint committee of each Society

being called for next Saturday. An earlier day would possibly be inconvenient to some of the members.

On the motion of the Rev. Mr. Wight, it was then resolved—"That the Council, with the Mayor and Mr. Bernays, be invited to attend a meeting to be held on Saturday afternoon."

Mr. Wight explained that the present meeting was to be considered in the light of a preliminary meeting, and the suggestion as to recognising Mr. Landsborough's services in the manner proposed, was to be understood as emanating from the Philosophical Society.

GENERAL REPORT.

The Rev. Mr. Bliss then read the draft of a Report of the progress made by the Society since its inauguration on the 1st March, 1859, to the present time, which, with a verbal amendment, suggested by Mr. Coote, was unanimously approved and adopted as follows:—

Queensland Philosophical Society, 1862.

President—His Excellency Sir G. F. Bowen, G.C.M.G.
Vice-President—Charles Coxen, Esq.
Council — H. Rawnsley, Esq.; Rev. R. Creyke; Rev. J. Bliss; Dr. Barton; S. Diggles, Esq.
Treasurer—Alexander Raff, Esq.
Auditors—Rev. R. Creyke, E. Mac Donnell, Esq.
Secretary—Dr. Barton.

Report

Of the proceedings of the Society presented to the Annual Meeting held at the Board Room of the Brisbane Hospital, on the 2nd December, 1862.

As the present is the first report of the Society, it has been thought desirable to give a brief sketch of its operations from the commencement.

The Society was inaugurated at a meeting held on the 1st March, 1859. The main object is the discussion of scientific subjects, with special reference to the natural history, soil, climate, and agriculture of the colony of Queensland.

In carrying out this object several original and valuable papers by resident and corresponding members have been read at the various monthly meetings of the Society, of which the subjoined is a list:—

On Asphyxia	Dr. Barton
The microscope and its application to insect structure	Mr. Diggles
Remarkable features and peculiarities of several Australian birds	Mr. Rawnsley
On the geological character of the country around Brisbane	Rev. G. Wight
Ventilation of buildings	Mr. Tiffin
Cotton and Queensland	Mr. Brookes
Landscape designing	Mr. Hill
Tramways	Mr. Coote
The Marsupialia of Australia	Mr. Coxen
Statistical report on the climate and health of Brisbane	Rev. R. Creyke
The sewerage of towns.........	Mr. Coote
The geological character of Northern Australia, as affecting its geographical features	Mr. Gregory
Remarks on the infusoria ...	Mr. Diggles
Coral and coral formations ...	Rev. J. Bliss
Queensland and the cotton question.....................	Mr. Brookes
The drainage of land by tiles	Mr. Pettigrew
Some observations on a design for a bridge over the Bremer at Ipswich............	Mr. Coote
Flying squirrels of Australia	Mr. Rawnsley
The influence of climate on our domestic architecture	Mr. Coote

Meteorological and sanitary abstracts contributed regularly by Dr. Barton.

In order that the colony at large might participate in the benefits arising from the labours and experience of individual observers, the Society felt that the papers thus contributed should not be confined within its own limits; the Council, therefore, entered into an arrangement with the proprietor of the *Queensland Guardian* for printing them at length in the columns of that journal; the proprietor, at the same time, liberally undertaking to supply the Society with forty copies of each paper in a pamphlet form. It has been determined that these should remain in the custody of the Secretary until a sufficient number have been printed to form a volume.

During the past year the Society has completed its organisation by the election of its Council and officers at a meeting specially called for that purpose in August last. His Excellency Sir G. F. Bowen has kindly consented to accept the office of President of the Society.

With the view of increasing its utility and of benefitting the colony at large as much as possible, the Society has during the past year specially directed its attention to the formation of the nucleus of a museum of natural Science for which purpose the Government has granted the temporary use of some rooms in the Signal Station, on Wickham Terrace, as a depositary for such specimens as the Society have been able to obtain; and suitable cases have been purchased for their preservation. The Council feel called upon to acknowledge a debt of gratitude as due to Messrs. Coxen, Rawnsley, Waller, and others, for contributions of specimens of conchology, ornithology, &c., and to Mr. Tiffin for a valuable microscope. They further have to report a grant of money from the Government to the extent of £100 in furtherance of the objects of the Society.

In looking to the future, the great work now lying before the Society seems to be to procure

a site for a permanent museum in such a locality as shall be accessible to those who desire to consult the specimens and preparations it may contain, and also to render the collection as complete and valuable as the means at the disposal of the Society will admit of; and in carrying out this project, it is thought desirable that a portion, at least, of a permanent building should be erected with as little delay as possible, of such a design as would admit of enlargement and completion as the funds increase.

In conclusion, the Council trust that as soon as it becomes known to the numerous students in natural science who are scattered throughout the colony, that such a museum is in course of formation, which offers a safe depository for valuable specimens and a school in which the rising generation may learn the first steps of natural history, that they will be willing to aid the Society by contributions of specimens to the museum, and with communications relating to any branch of science which may come under their own observation.

JOHN BLISS, M.A.

ERECTION OF A MUSEUM.

Mr. PETTIGREW enquired whether the site of the proposed museum had yet been decided on?

Dr. BARTON replied in the negative.

Mr. COOTE said they would have to ask the Legislature for a grant to assist in the erection of a suitable building.

The CHAIRMAN was of opinion that they could with a good grace apply to the Legislature for a further grant when they showed how judiciously they had expended the money already granted.

The Rev. Mr. BLISS would suggest the immediate application to Government for a grant of land, as there seemed to be very little remaining available, suitable for the purposes of the Society.

The Rev. Mr. WIGHT said that it might be argued that before they commenced erecting a museum they should be in possession of something worth preserving in one; and he was glad to say that they were actually in possession of several valuable specimens without having a place to put them in.

Mr. COOTE was of opinion that in the present stage of the Society it was equally if not more necessary to obtain a suitable building for their meetings. It was not right or proper they should have at every meeting to intrude on the hospital.

Mr. PETTIGREW suggested that they should apply for the use of the Municipal Council Chambers.

After some discussion regarding the desirability of applying to the Government for a site whereon to erect the proposed museum, and for a grant in aid,

Mr. COOTE said he would move that application be made to the Government for a site.

Dr. BARTON said that, after the adoption of the report, such a motion would be irregular, according to the rules. He did not, however, desire to check discussion on the subject as it was of public importance; but would suggest that a notice of motion be given so that the matter could be entertained at the next meeting.

The CHAIRMAN suggested that Mr. Burrowes, the Crown Lands Commissioner, should be communicated with respecting the locality of the reserved land still procurable.

Mr. COOTE said the present Recreation Reserve would be beyond doubt the most suitable locality. The museum would thus be isolated as far as possible from all other buildings, by which no danger of fire could arise. The building the Society would erect would moreover be a great ornament to the grounds and be easy of access to the public. The Royal Society of Melbourne had received a beautiful piece of ground forming a triangle where three streets met—in addition to a grant of £6000. He would move "That at the next meeting of the Council the subject of obtaining a site for a museum be entertained."

This motion having been seconded by the Rev. Mr. CREYKE, and carried,

The business of the meeting terminated.

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THE ANGLO-AUSTRALIAN TELEGRAPH.

A PAPER READ BEFORE THE MEMBERS OF THE PHILOSOPHICAL SOCIETY OF QUEENSLAND, BY J. J. AUSTIN, GENERAL SUPERINTENDENT OF TELEGRAPHS, MARCH 3, 1863.

An extension of the Australian Telegraphic System to England, *via* India, being a subject of the highest importance, not only to Queensland, but to the Australian colonies generally, it is hoped that the following sketch may prove interesting, although time will only permit me to give a brief outline.

It may be considered desirable, in the first instance, to refer to the negociations between the original promoters of the Anglo-Australian scheme and the Governments of the various colonies interested therein. Certain banks and mercantile firms in England, impressed with the conviction that a line of telegraph connecting China, India, and Australia with Great Britain, would be a matter of the utmost commercial value, combined for the purpose of carrying out this great work. In the year 1859, Mr. F. Gisborne, who represented the promoters of the undertaking, visited Australia in order to procure subsidies for a line between Java and Queensland. The capital proposed at the time mentioned was £800,000, and an annual subsidy of £35,000 was asked to raise this amount. Of this subsidy, Victoria voted £13,000, New South Wales £9,625 ; the remaining portion, £12,375, was to be contributed by the other colonies together with the Imperial Government.

Certain matters interfered to prevent the project being carried out within a reasonable time, consequently the sums voted by the colonies, in the year 1860, lapsed. Lately, however, a fresh statement has been issued by the promoters, whose objects, according to the prospectus, are, "to establish telegraphic communication between India and Australia, and between India and China, the effect of which will be to bring Australia and China into nearly instantaneous communication with India, and with each other, and within, say, sixteen days of Great Britain. "When telegraphic communication is re-established between Egypt, or Turkey in Asia, and India, the communication between Great Britain, China, and Australia will be further reduced from sixteen days to about as many hours."

Three lines of telegraph are proposed with the view of carrying out these objects :—

1st. A submarine line from Rangoon, the present terminus of the Indian telegraphs, to Singapore, 1200 nautical miles, with intermediate stations at Amherst, King Island, and Penang.

2nd. A submarine line from Singapore to Hong Kong, via Sarawak, Labuan, and Manilla, 2080 miles ; or via the settlement of Saigon, 1678 miles.

3rd. From the east end of Java to Brisbane, a submarine line of 3024 miles, with intermediate stations at Coepang, Port Essington, Cape York, and Cleveland Bay.

The Dutch lines at present connect Singapore with Batavia and the east end of Java, the starting point of the line last mentioned, and with which the Australian colonies are more immediately concerned.

It is understood that either the Indian or the Imperial Government will carry out the first section, from Rangoon to Singapore. Having written to the Hon. the Colonial Secretary, shortly after his departure from Queensland for England last year, explaining my views upon the matter now brought before you, I have in reply received a letter stating that he had "communicated with the Under Secretary of State for India upon the subject." He mentions "that at present there is a question respecting the section between Rangoon and Singapore, whether this is to be at the expense of the Treasury or India."

The promoters have applied to the French Government for a subsidy in connection with the second section mentioned from Singapore to Hong Kong *via* Saigon.

The Australian Colonies are now again asked to assist in carrying out the third section, from Java to Brisbane, and thus complete a link in the chain of this vast telegraphic system.

Since Mr. Gisborne's scheme was last before the public, it has been found necessary to recommend the use of a much heavier cable than that formerly suggested, and for this purpose a capital of £1,100,000 would be necessary to meet the expense of the Java-Brisbane portion, 3024 nautical miles.

A question here arises as to the advisability of carrying a submarine line, of this length, and at such a great outlay, completely round our northern and eastern coast to Brisbane. It certainly appears to be not only unnecessary, but very undesirable also in a pecuniary point of view, seeing that much more than a third of the sum asked for may be saved by constructing a line partially overland. This, however, though a matter of moment, is not by any means the greatest advantage to be gained by adopting an overland route. With such a length of submarine cable as that proposed, serious delays must reasonably be anticipated, while land lines can at the same time be much more easily kept in constant working order, and defects or breakages speedily repaired, thus tending to keep up a greater certainty and rapidity in communication.

The highest advantage, however, arising from the adoption of an overland line, and one of paramount importance to Queensland, would be the rapidity thus induced in the opening up of our already prosperous colony for further settlement. The result would be a speedy influx of population and capital, and the occupation of the vast tracts of rich country recently discovered by various explorers. The Electric Telegraph, hitherto considered as a valuable auxiliary to civilisation, would in this case become its pioneer, leading to results greater than the most sangnine may even, at present, anticipate. The course of this overland line naturally lies through Queensland, and in such a worthy undertaking we may reasonably look for encouragement and aid from the adjoining colonies, should such assistance be necessary.

It is anticipated that our telegraphic lines will very shortly be in operation to Rockhampton, a distance in a northerly direction of about 400 miles from Brisbane, and there can be little doubt that Queensland will quickly extend her lines still further, about 400 miles, to Port Denison, the most northern occupied settlement in this colony. By referring to a map it will be observed that, starting in a north-westerly direction from this point, a line of telegraph could be with facility carried forward to the Albert River, or any other desired position at the south of the Gulf of Carpentaria, a distance of about 800 miles; keeping somewhat in the direction of M'Kinlay's route, but at the same time avoiding the bad country he mentions having encountered. The Surveyor-General of our colony, who has passed over the greater portion of the proposed track, informs me that there are no peculiar difficulties arising from the nature of the country, that may not be overcome by a little energy and perseverence, in the construction of a telegraph line. Protection from the hostile natives would, of course, be required, even after the establishment of telegraphic communication, till this portion of the colony was fully opened up and settled. Such protection could be easily afforded by a proper number of Native Police, in charge of European officers, placed at each telegraph-repairing station, within distances of seventy or eighty miles. The selection, however, of such a position as the Albert, for the point of departure of a submarine cable to India *via* Java, is, of course, a matter for future consideration, and some other route may probably be proposed; but the direction indicated would certainly tend much to the rapid opening up and final settlement of the northern portion of Australia, including the rich country south of Carpentaria discovered by Landsborongh upon his late expedition. Supposing that the vicinity of the Albert should be chosen as the point of departure for the submarine line, a route crossing two of the larger islands at the south of the Gulf might be adopted, terminating in the first instance at Cape Wessel, a station that would

doubless prove of great value to shipping interests. From that point to Cape Van Diemen, at the north-western extremity of Melville Island. From Cape Van Diemen to Coepang; and thence to Cape Sedano at the eastern end of Java. This route would divide the submarine cable into sections of convenient length.

A second route may next be suggested by continuing the land line already mentioned onwards from the Albert to Port Essington, and thence by submarine cable to Coepang and Cape Sedano.

The relative cost of the two lines now proposed would be as follows:—

1st Route.—Submarine Section.

	miles
From Cape Sedano to Coepang	590
,, Coepang to Cape Van Diemen ...	420
,, Cape Van Diemen to Cape Wessel..	420
,, Cape Wessel to the Albert	500
Total ...	1930

1930 nautical miles at £375 per mile, £723,750

Land Section.

From Rockhampton to the Albert, 1200 miles, at £100 per mile ... £120,000

Total cost ... £843,750

2nd Route.—Submarine Section.

	miles
Cape Sedano to Coepang	590
Coepang to Port Essington	525
	1115

1115 nautical miles at £375 per mile, £418,125

Land Section.

From Rockhampton to the Albert 1200 miles at £100 per mile ... £120,000

From the Albert to Port Essington, 900 miles, at £100 per mile ... 90,000

Total cost ... £628,125

On comparing the totals just mentioned with the estimated cost of the corresponding line proposed by Mr. Gisborne, it will be found that a saving can thus be effected of £256,250 by adopting the first route; and of £471,875 by choosing the second.

The cost per mile, including all expenses, is taken at the same rate, for the submarine cable, as that stated to be necessary by Mr. Gisborne, although a considerable reduction might possibly be made without impairing the efficiency of the line. For the land sections, the estimated cost of £100 per mile should be amply sufficient, both for construction of the line, and the erection of stations, including instruments, &c.

In passing across the unsettled northern districts a matter for consideration suggests itself as to the description of telegraph line that might prove most suitable to the peculiar nature of the country. It would probably be advisable to use posts of greater strength than those ordinarily employed, and wire also of considerably increased thickness, but few other alterations in the present mode of construction would be required. Only one wire is necessary to work our instruments according to the Morse system, but it would be desirable to have two wires carried along the line of posts, so that one might be devoted exclusively to British and Foreign business, the second wire being reserved for local telegrams and business of a departmental nature. In the event of accident to one of the wires, the service rendered by the other might in many instances be invaluable, while the additional cost of construction would be comparatively trifling.

The repairing and working stations should consist of strongly-built stockades, in order to afford sufficient protection from the hostile natives. In addition to the electricians required to work the lines, two European non-commissioned officers and three or four native troopers should be placed at each of these stockades. Those men could be trained easily to repair the wires when broken, and render general assistance in other matters. In the event of accident to the line, one-half of the men could at once be sent out on repairing duty, while the rest remained at the station for its protection.

In every case telegraph lines should, where practicable, follow the course of main roads, or, where none exist, at least take the direction properly surveyed and marked out for future roads. Clearing away the growing timber would in the latter case be an immediate means of aiding ordinary traffic, and the presence of a protective force, such as suggested, would of course check the inroads of the aborigines, and add to the general security of the inhabitants in those unsettled districts. It should, therefore, be borne in mind that by the extension of telegraph lines roads are opened, and a large proportion of the cost of construction is so much money spent upon their formation. This view of the subject escapes the attention of many. Queensland has everything to gain from the opening up of her rich northern territory, and may therefore be expected to aid largely in carrying out an Anglo-Australian line. But independently of this, although the cost of construction is considerable, the money required

would be very judiciously expended. To be the first in position telegraphically to England, India, and China, would be an advantage of vast importance, while within a very few years after the opening of the lines, the Queensland section would doubtless prove to be a source of considerable revenue. The colonies would have control over the tariff, and Queensland's advantages would, of course, be in proportion to the length of her lines.

To carry a wire from Rockhampton to the Albert, or to the western boundary of the colony, not far from that point, would cost, according to the estimate given, £120,000, which, raised by loan at 5 per cent., would only amount to £6000 per annum. This is a great national work, and Queensland may reasonably be expected to extend her lines as far as suggested. The adjoining colonies would doubtless very willingly unite, under such circumstances, in a subsidy to carry the line onwards to Java, and it is not at all improbable, in the event of the adoption of the second route mentioned, that South Australia alone would carry forward the wires, without hesitation, to Port Essington, as that territory will shortly be placed under her protection. With regard to the working expenses and maintenance of the land line, it may be expected that New South Wales, and probably Victoria also, would contribute a fair proportion until the receipts arising from the general business became after a few years a source of revenue.

By availing herself of the circumstances now placed within her reach, Queensland may hereafter become one of the greatest of the Australian Colonies in prosperity, wealth, and influence. If she now fails to act with promptitude, such a fortunate chance most probably will never again occur. It must be remembered that while we hesitate, other colonies are anxiously turning their attention to this subject, and that any indifference or short sighted policy on our part will lead to unfavourable results, the full weight of which may only be experienced in after years, when it will be found too late to call back, "Queensland's opportunity" now placed so clearly and invitingly before us. It is therefore to be hoped that all our colonists will cordially unite in aiding this worthy undertaking by wisely adopting broad views upon the great question of the "Anglo-Australian Telegraph."

FAIRFAX & WIGHT, PRINTERS, "QUEENSLAND GUARDIAN" OFFICE, BRISBANE.

PHILOSOPHICAL SOCIETY
OF QUEENSLAND.

The following paper by Mr. Diggles was read before the Philosophical Society, on Tuesday evening last.

ON THE USE OF INSECTS TO MAN.

That every thing has its use, is a fact which few will question, and although the world teems with objects, the direct use of which is unknown, it is generally admitted that they must be of some utility, otherwise they would not have been created. Even concerning those things of which we know very little, we are able often to form surmises and conjectures respecting them, and every day's experience shews we have a right so to think as we hear of fresh discoveries made. Thus it has come to pass, that many substances which we formerly thought useless, have been found of great value, and that which was a little while ago thrown away as rubbish, has been carefully stored and turned to account. The productions of earth are so varied, each clime having its peculiar ones, that all nations are able to add somewhat to our stock of knowledge, and even the most savage tribes can doubtless contribute some small amount of information concerning things about which the rest of the world are ignorant. It would be a curious task, and one of great interest if possible to be accomplished, to catalogue the various useful discoveries which man has made since his first primeval condition. Many are doubtless lost and will have to be found out afresh as time rolls on, and no less interesting is the speculation relative to the future; for judging from the amazing impetus which discovery has received during the last hundred years, many, very many of the common objects which we now pass by in disregard, will probably be found teeming with interest and sources of wealth, industry and comfort. Many very valuable discoveries are of great antiquity, in fact they are of so remote an age, as only to be mentioned by the most ancient historians, as matters of course. The benefactor of his species, who sowed the first corn field, or steeped and propared the first flax plant. The man who first extracted iron from its ore, or constructed the first ploughshare. Their names are long ages ago forgotten, but the benefit of their labor remains. Of all departments in nature where we might least expect to derive any particular benefit, the insect world is that one. That such insignificant beings should be capable in any measure to minister to the wants, comforts, or luxuries of manhood would seem a far-fetched idea, and yet it is the truth. For ages in China it has been known that the cocoon of the silkworm moth was capable of being manufactured into garments of surpassing strength and richness, and that ingenious people, as well as the Hindoos, have been in the habit of using this beautiful material, and making it an article of valuable commercial importance for thousands of years. About the 6th century, the eggs of the silkworm moth were brought from India to Constantinople by some monks, who, doubtless from the great trouble they must have been at to convey them without injury so long a distance, must have had a pretty shrewed notion of the future importance of their valuable contribution to the western world. Silk then brought its weight in gold, and gold was many times more precious than it is now.

The services rendered to mankind by insects may be classed as direct and indirect. That—from their vast numbers, also when not duly kept in check—they are capable of inflicting severe injury is well known, as in the devastating power of grasshoppers and locusts, and various species of catterpillars. But that the services they render far outweighs any damage they may at times do is, I think, easily proved. But, I must not dwell on the power they possess, hurtful to man, but on the benefits which he derives from an acquaintance with their habits. Food being the first of bodily wants, let us see what insects can furnish in this respect. Locusts have been eaten by many nations from an early period of the world's history down to the present day. It is a singular fact, related of John Baptist in the Scripture narrative, that both the articles of his diet named are connected with insects, *one*, the insects themselves, and the *other* the. product of insects. That a considerable amount of nutriment exists in locusts I have no doubt, from the quantity of oily and muscular substance which is within them. They are generally roasted, stripped of legs and wings, and pounded in a morter, so as to form a kind of paste. It is said, however, that this description of food is not the most wholesome, but like many other customs, what was at first done as a necessity, became afterwards a custom or choice. Various kinds of larvæ are also used as food by different nations. The ancient Roman epicures were very fond of a grub called "cossus," supposed by some to be the larva of the goat moath (*C. Liginpenda*), and by others that of the stag beetle (*Lucanus Cervus*). However this may be, both insects are very large and conspicuous, and would form a morsel considerably exceeding in size the largest shrimp, to which crustacean I believe many of ourselves will confess a liking. That such things should not be eaten because of their disgusting appearance is a foolish argument and is at once met by the fact that even oysters are considered a delicacy by most civilised people. Somebody has said the man that eat the first oyster had plenty of courage, so he had—even more than the one who devoured the first grub. Now it happens

that in Australia there are various larva of very large size, some five or six inches in length; these form a portion of the food of the aboriginal population of the country. They belong to a genus of moths (*Zeuzera*), nearly allied to the cossus before-mentioned, and which seems to me an argument in favor of that being the one eaten by the Romans. I believe the habit of the blacks is to dig them out of the trees in which they feed and roast them. They are said to have a nutty flavor. But that for which we are most indebted to the insect tribe in the way of food is the article of honey. This is a production known from very early times, and long before the sugar cane was *pressed* into the service of mankind, honey was used for all the purposes that sugar now fulfils. That two such valuable articles as honey and wax should be the product of one particular kind of insect is not a little remarkable, and is an instance of the great bounty of the Creator, who gives us liberally all things we enjoy. I may remark here that the hive bee is, as it were, a domesticated insect, and like other domesticated animals, can accompany man almost wherever he goes. Thus, since the introduction of the common hive bee into this country, it has thriven to such an extent as to have become quite common, stray swarms taking up their abode in hollow trees, and sending off swarms further and further west, until at last it has penetrated inland some hundreds of miles, and will doubtless in time meet its fellows from Swan River, thus spanning the continent. Many other bees produce honey, and in larger quantities, as was well known to the natives of this country before it was visited by Europeans. But the insect is small which is here called the native bee, and even said to be without a sting (rather anomalous in a member of the hymenoptera); this, however, I think questionable. In consequence of the minute size of the native bee, their honey gathering powers must be very limited indeed, compared with the domestic bee, although old-established colonies of these insects produce very fine honey, and in great abundance. The bee has also doubtless conferred much benefit upon mankind as being the medium through which the fertilizing pollen is conveyed from flower to flower of the various flowers and fruits. Thus, in most instances, have the different varieties of apples, pears, and other valuable fruits been produced.

The next want of man is clothing. What can insects do to supply it? Certainly we ought not to expect them to compete with the larger members of the animal kingdom, the producers of fur and wool so extensively used. No, these materials are suited for the commoner articles of clothing, but those delicate and brilliant threads spun by caterpillars are too costly to be implied for common purposes. The vegetable and animal world, that is to say, among the quadrupeds, minister to man's necessities, the silkworm to his luxuries, the former appeal to his notions of utility, the latter to his sense of beauty. For what is more splendid than a velvet robe or some of the more costly silken tissues only to be surpassed by the lustre of the Bird of Paradise or the humming bird? The great demand for this beautiful material has stimulated the industry of large communities. I shall not dwell upon the methods employed in manufacturing this article, as information on this point can be obtained from a great variety of sources, suffice it to say the caterpillars receive the utmost attention, their requirements in the shape of food, ventilation, and cleanliness, being carefully looked after to ensure a plentiful return. The animal, when arrived at its full growth, prepares to change into the chysalis state, which it does inside the beautiful cocoon it first forms. It is not generally known that the cocoon of a silkworm is a far more elaborate affair than it seems. The silk is not wound round and round as we should do it (only from the outside), but it is arranged in a series of zig zags, having a tendency to a circular direction, the silk is exuded from a small organ called the spinneret, situated beneath the head, this is applied to any point to which the insect intends to attach the silk, which though liquid within the body of the caterpillar instantly hardens on exposure to the air. Having first as it were laid the foundation by attaching threads from one point to another, it in a wonderful manner forms the first thin pellicle of the egg-shaped cocoon, and continues adding layer after layer in the zig zag method before mentioned until a small hollow space remains which the insect fills partly with a case of different material from the other part of the cocoon, it somewhat resembling thin parchment, in this it undergoes the change from the larva to the chysalis state. A few of the cocoons are reserved for breeding—all those from which the perfect insect is allowed to come forth being destroyed by a certain secretion emitted which dissolves the silk at one end of the cocoon, thus allowing the insect to emerge. The rest are killed by heat. The coocoons being placed in boiling water are unwound, and thus is produced the raw material, as it is called. The climate of Australia is well fitted for the silkworms, and also for the mulberry tree, on which it feeds, and it is quite within the range of probability, that where population increases. and labour is cheap, it will be the means of employment to large numbers of colonists. In India, there are several other moths of the Genus Bombyx, which being of large size, produce silk in considerable quantity. But, unlike the cocoons of the silkworm moth, those formed by these issects cannot be readily unwound. It is, therefore subjected to a process of carding, and being coarse and strong, is woven into garments of such durability as to last for many years. In this country we have several—Bombyces, whose cocoons, if necessary, could be treated in a similar manner, and doubtless with the same result. The silk produced by spiders has also been woven, but more as a curiosity than anything else, as the quarrelsome and bloodthirsty nature of those crea-

tures is such as to prevent any attempt to rear them in company, and even then, it is only a certain portion of the silk which could be so employed, the rest being covered by the sticky exudation by which they entrap their prey. An examination of any good work, such as Macculloch's Dictionary of Commerce, will give any one who wishes to inquire into the subject of silk manufacture, such fully and satisfactory information that I shall not say a word about it. I shall now briefly notice insects useful in dyeing. The Cochineal insect is, of course, of the greatest importance in this respect. To it we are indebted for our most brilliant scarlet and crimson tints. As a pigment, Carmine stands unrivalled in power and brilliancy, but as painters well know, it is open to a grave objection—that of its liability to fade. The man who could invent a way of making this splendid color permanent would confer a boon upon art itself. In consequence of the fleeting nature of the color, painters who value their reputation must be content to use others, which, though less brilliant, are much more durable. Madder is found to be the best substitute, but as this is a vegetable product, I must not speak of it here. The color called *lake* is also a product of the insect world. The family to which both the cochineal and the lac insects belong is the homoptera, genus coccus, a very extensive one in this country and many others. This genus (coccus) is nearly allied to the aphides, and is of similar habits. Fixing themselves on one spot of the branch of a leaf of the particular tree to which they are attached, and sucking out the juices. Strange and wonderful chemistry that these juices should become so changed in their passage into or through these creatures, as to form in one a sugar, in another a wax, and again in another a resin or a dye. The whole body of the cochineal insect is permeated with the brilliant coloring principle. These singular insects feed upon the nopal, sometimes called the cochineal cactus. It is the female insect which yields the dye. The West Indies, Mexico, and some parts of South America, are its natural habitat. The collection of these is a very tedious and, probably, painful process. The plant being of a prickly nature, in fact, like the prickly pear, it is requisite to use great caution; and, accordingly, they are brushed off into bags, and killed by dipping in boiling water: after which, they are exposed to the sun to dry them. When they look like dry shrivelled seeds, of a dull purple tint, mingled with a powdery bloom of a whitish cast. The lac insect is attached to various species of the fig tree. In consequence of its attacks upon these trees the small twigs or leaves become encrusted with what is at first called stick lack, which, after being boiled in water, lose their dark color, when they are termed seed lack. This, when melted and pounded out on a flat surface, hardens and becomes the transparent substance well known as shellac, so useful in varnishes and French polish, and also as being the material employed in the manufacture of sealing wax, for which it is well suited on account of its hardness. The beautiful Japan ware owes its durability to this substance, as it is not so readily scratched as other varnishes. The colouring matter called lake, though not nearly so valuable as cochineal, is largely used for dying purposes. It and shellac form a valuable article of commerce. In this country the wild fig is much infested by a species of coccus, which it is quite possible might be found to produce some such substance as what I have just described.

Nearly allied to resin is wax, and here again comes the honey bee and its wonderful comb, fulfilling the requirements and solving the problem of the smallest quantity of material and the greatest strength, as well as the most suitable form in the least compass. Wax has been used from time immemorial. After being bleached it becomes a very beautiful substance, and is in this state used in the arts. It would be very difficult to enumerate the great variety of uses to which this article is adapted. It has long been the favorite source of artificial light, probably nine-tenths of the bees wax collected goes for this purpose. In Catholic countries the consumption must be enormous from the vast number of candles used in their religious services. The absence of smell and smoke render this material valuable when the use of gas would ever be objectionable, as in picture galleries, or in places where delicate works of art are exposed. The apothecary is largely indebted to this substance in the preparation of ointments, plaisters, &c. From the great success which has attended the introduction of the domestic bee into the Australian colonies, it is not improbable that when an extensive agricultural population settle in this district, wax as well as honey will become a valuable addition to our exports. While mentioning beeswax in a medical point of view, I may briefly here introduce the Spanish fly, or, as it is scientifically termed, the cantharis vesicatoria, a species of beetle found in most parts of Europe, and rarely in England. There are several other species of the genus which possess the same properties. They are principally used for causing blister, a remedy very necessary, on the principle of choosing the least of two evils. They are also a powerful poison, and when used as a medicine are always employed with the greatest caution by the physician. It is said that when alive their presence can be detected at some distance, thus forming a guide to those who are in the habit of collecting them. When touched they emit a odour most offensive, and must be handled lightly, as their blistering powers are most potent. They are generally killed by exposing to the steam of vinegar, but sometimes by immersion in boiling water. The insect itself is very pretty, being of a shining green colour, and under the microscope forms a splendid object. Another insect not far removed from the cantharis is the meloe, or oil beetle. If these insects could only be procured in sufficient quantity they might be found of

great value, as they contain a considerable quanty of oil, which is used in Sweden as a successful cure for rheumatism. The history of this insect is peculiar. The female insect lays eggs in the earth, and the larvae which comes forth being exceedingly active attach themselves to bees and other insects, to which they adhere like leeches. clinging so tightly as to render it impossible for the insect to get rid of them. Accordingly being carried to the nest or hive they feed either upon the food supplied for the larvae or on the juicee of the larvae, to which when full grown they bear a great resemblance. In Australia we have several (in fact many) kinds of caterpillars, whose hairs are capable of causing great irritation. Whether they could be found useful in the way that the cantharis is employed remains to be proved. Various kinds of the coccus tribe exude substances of a sugary nature, but not of quantity sufficient to make them serviceable to man. The ants, however, know well how to make use of them. If we examine any small sapling we shall, generally find the ants busily employed ascending and descending. A little observation will show the reason. Fixed to the branches we shall observe little whitish or redish lumps of apparently inanimate matter, these are the cocci, busily employed in extracting and transmuting the juices of the plant into the much coveted material. The ants may be observed carefully licking away the exudation which is given forth, and when satisfied making way for others to take their place. Another tribe of the homoptera to which these cocci belong is the cercopidæ, or as they are sometimes called, from their form, frog-hoppers. Their habits are similar to those we have just been considering, and the ants pay similar respects to them. The cicada family are numerous in this country. They belong to the homoptera also. Commonly, but erroneously called "locusts," the ear is often deafened by their shrill noise, like a knife-grinder's wheel. These insects are many of them of a very large size, and are often to be seen collected in great numbers upon the freshly-peeled bark of the gum trees, sending down showers of sweet rain, for as they are incessantly sucking they must give out the sweet liquor in great quantity. I can not see any way of turning this material to account, though it is possible some one might be discovered. It has been gravely asserted by several respectable authors that the lady-bird beetle (coccinella) as well as several other coleopterous insects, are a cure for the toothache. This is a most extensive genus in this country, and it would be well worth trying. One author says that, when crushed, the finger becomes so imbued with the virtue as to be of service for several days. The Gall insect must now come in for a short notice. Galls, as is well known, are certain vegetable excrescences found on a great variety of trees and plants. That of the oak is well known and highly valued for making ink, and for the purposes of dyeing. The gall insects belong to the hymenopterous order, and are usually of minute size. The female insect is furnished with an ovipositor, with which she punctures the leaves or stems of plants, depositing an egg in each hole. A species of vegetable irritation sets in, which causes a remarkable change in the plant. which, instead of giving forth leaves and shoots, become swollen, in many cases, as in the gall of the oak, developing itself into a nearly solid ball, of a woody texture; in many others, of very irregular form, as we may see exemplified in that of the wattle tree: and in others, a hard nucleus, covered with a mossy hair like what we sometimes see upon the rose tree. It appears that the peculiar principle of the tree becomes concentrated in these galls, if we may judge by that of the oak; tannin being an important constituent, also the useful photographic agent gallic acid. It is worthy to be noted, that as oak bark is here replaced by that of the wattle tree for the purposes of tanning, it is more than likely that the galls of the same, which can be procured in immense quantities, will be found worthy of attention as an article of commerce not much inferior to those of the oak. The study of the gall insects of Australia would form a delightful employment for any naturalist, who would find work in abundance for years, and enrich the science with many new and interesting facts among insects. I have thus enumerated some of the most interesting and useful productions of the insect world to man. The catalogue might doubtless be considerably added were more sufficient attention paid to this subject, and, doubtless, as time rolls on, much more will we be indebted to the insect tribes than we are at present. The study of these minions of creation is in itself a benefit to man, of no ordinary kind, opening out to us views of the Creator's power and goodness in small things, happy in the enjoyment of their short existence, (in some cases extending only to a few hours), and *ever* without deviation following the law of their creation, they read us a useful lesson to do likewise. On another occasion I may again take up this topic, and dwell upon their indirect uses to mankind, which will be found to be manifold. Any imperfection in the way of composition will, I am sure, be pardoned by you, as I did not aim so much at the choice of language as to place before you practical and useful facts.

S. DIGGLES.

June 2, 1863.

Since the above was read I have perused a very interesting paper by H. L. Schrader, Esq., member of the New South Wales Entomological Society, who has been devoting great attention to the study of the gall insects of that locality. It appears from his observations that to the family of the coccidæ, with few exceptions, is due the formation of the very singular excrescences we see on almost every tree.

S. D.

PHILOSOPHICAL SOCIETY

OF QUEENSLAND.

THE LYRE BIRD OF AUSTRALIA.

A paper read before the Queensland Philosophical Society, by H. C. Rawnsley, Esq., on the 4th August, 1863.

MENURA SUPERBA.

THE LYRE-BIRD, OR MOUNTAIN PHEASANT.

This extraordinary bird, peculiar to Australia, which together with the Emeu and Kangaroo, are selected as the heraldic bearings and emblems of this country, has given rise to much discussion among naturalists; classed first among the Birds of Paradise, and afterwards among the Gallinaceous birds, to which it has no affinity, but forms, with other genera, a family of the Insessorial or Perching birds. So little indeed was known respecting it to a very late date, that a gentleman who was arranging the birds in the museum of an adjoining colony, insisted (notwithstanding my relation to him of its habits as studied by me in its stronghold the Illawarra) in classing it with the Peacocks of India, Java, and Ceylon.

To the eminent naturalist, Mr. Gould, we are indebted for placing this bird in its true position in the natural system; it belongs to the family of the Wrens. Great indeed is the contrast between the common English wren and the Lyre-bird, they apparently belong to different orders, nevertheless the relationship can scarcely be doubted, and when we pass from the examination of the English bird to some of the splendid species which are natives of this continent we are at once struck by the extraordinary similarity which exists in the character of their plumage and that of the Lyre-bird. Take *Malurus Cyaneus* (Superb Warbler) and *Malurus Lamberti* for instance, found in the same bushes as their giant relatives, there are the like long silky feathers along the back, entirely covering the wings at the pleasure of the bird, and protecting them from the moisture with which the dense vegetation that clothes the hills and gullies is generally saturated. In the tail of the Emeu Wren (*Stipturus malachurus*) there is an approach to the slender feathers of that of the menura, while the malurine birds like the lyre bird all carry their tails erect, like them it has the bristles at the base of the bill, similar powers of running and great feebleness of flight. The nest and eggs of most birds are a good guide to the families to which they belong, and those of the menura at once indicate that of the wren; the nest is domed like that of the malurus. The egg (first described by Mr. Gould, in 1859) is about the size of that of an ordinary fowl, the length being two seven-sixteenth inches, and the breadth one thirteen-sixteenth inch; "it is of a purplish stone color, blotched and stained all over with a much darker and more olive brown at the larger end, where it is is more profusely disposed than on any other part of the egg, and forms, in fact, a kind of zone." The menura lays, I think, but one egg.

The food consists of insects, centipedea, and coleoptera and shelled snails, which abound in the rotten wood that lies piled to a considerable depth in the gullies. It will possibly convey some idea of the great power of limbs and strength of claws when I state that I found

decayed trunks of trees torn as if splintered by an axe by these birds in their search for food, while the fallen branches and dead leaves in more exposed parts of the mountain side were tossed about and piled as if hay-makers had been at work.

I am not certain how far it ranges to the westward of Melbourne, but I found it in the lofty ranges of the Plenty, about 25 miles from Melbourne; it abounds in the dense cedar brushes of the Liverpool range, and, according to Dr. Bennett, the mountains of the Tumut country are among the places of which it is the denizen. I believe that it is not found within the colony of Queensland, nor in the colonies of South and West Australia.

Early in the month of September, some years ago, having slept the previous night at a farm hut in the mountains of Illawarra, I started before sunrise for the home of the Menura; it was a fine clear moonlight morning, and being familiar with the features of the country, I knew that I should be among the higher gullies when the sun rose, in time in fact, to place myself in ambush before the lyre bird commenced his morning song. I had never seen one alive—never hunted one before: but I was quite aware of their extreme shyness, and of the great importance of moving without a sound—an accomplishment only gained by practice, but essential to scrub shooting, for all is still in the dark recesses where the Menura has his home. You hear at times of early morning the note of the Satin bird from the vines, the King parrot calls plaintively at intervals from over head, or a flight of screaming Cockatoos pass by, making for water, but the crackling of a twig, the chance displacement of a stone, or the rustle of a bush, sound loudly in the general hush; farewell, when this happens, to your morning chance. The day was just breaking, and I had left the cedar cutter's half obliterated track, and was hanging by a vine to the face of a cliff looking down on a sea of cabbage palms, tree ferns, vines, and climbers of endless variety, and watching for the appearance of the sun from beneath the far off horizon of the still ocean beyond, when just as his first rays fell upon the rocks around me, I heard what I supposed to be the rich, clear, bold note of the Satin bird: anxious to procure a good specimen, I for the moment, forget the special object of my chase and cautiously climbed the cliff, again the call was repeated, but was immediately followed by the voice of the white cockatoo—then the mocking powers of the Menura were remembered, and I stood rivetted to the spot, proceed I could not, for having swung myself to the top of the cliff, I found a platform of broken rocks, about an acre, without a particle of cover, and in the centre a few huge trees, and a mass of tangled vines, the growth of centuries, from which the sounds proceeded. I crawled like a cat, and with like stillness, but without success. Cheered by finding myself in the vicinity of my game, I proceeded cautiously along the mountain, and in a little while caught the note of the bird far off. With great toil and patience, I got within gun shot, but so dense was the cover, I could see nothing beyond my gun: fearing I should lose my chance, I determined to advance, and in half a dozen paces, found myself almost within pistol shot of a male bird, a female, and a half-grown young one. Of the male, I got but a glance, with a note of alarm, and one or two wonderful bounds he was in a second or two half way down the mountain. The young bird screeching ran into a hole in the rocks, where I caught it, and the mother then attracted by its cries of distress rushed to my feet, and was shot. The thought then struck me that, if I fastened the young bird to the ground, and hid myself in the fern, that its cries might draw the male to its assistance. I did so. Its call was incessant, and at the expiration of half an hour I saw, not the male, but a female steal cautiously out from the fern not five yards from me. I remained as silent as the rocks around me for several seconds. The pheasant did not move, but kept staring at the fettered young one, when, slightly moving my gun which I had brought to my shoulder, she saw me, and vanished. Once more during the day I got within five or six yards of a cock; but so dense were the stems of the brushwood that I could not find the slightest opening to give me a chance. I could make out something moving as behind a close blind, but nothing more. I fired, but although so near, the torn bark of the brushwood was the only result. The young bird I had left behind me, and picked it up on my way home. I fed it with every care, but it died in four or five days.

About a week afterwards I again found myself in the mountains. I had shot a white necked fruit pigeon (*Carpophaga leucomela*), and it had fallen at least 200 feet down into a gulley grown over with vines. Having secured it, and reloaded, I was in the act of climbing the hill when, under the bushwood within gun-shot, I saw a hen pheasant feeding. I leant forward to fire, against a pile of dead wood, when a violent screech came from the interior. To my great delight I found the pile of dead sticks to be the nest of the Lyre bird. In it was a young one, two thirds of the size of the female, quite fledged; but wanting the handsome tail. The hen at the cry of distress of the young bird started forward, but was killed at the instant. The nest was on the ground, at the foot of an old tree, and partly in a recess in the trunk; it was domed and lined with fine fibres and very thin vines, but no feathers—about the size of a tea chest.

It is impossible to give an idea of the great dtfficulty of obtaining this bird *i. e.* by the amateur sportsmen. Apart from its extreme shyness it is incessantly on the move—perhaps after hours of patient following the note of the bird (for you do not see it except to kill or lose it), over rocks and fallen timber, through all but impenetrable masses of vines and thorns holding you fast at every step; now up the wall like face of the mountain, and now back on your track, five or six hundred feet precipi-

tously down—now over prostrate trees, piled one on another, green with slime and moss, dripping with moisture, shrouded in gloom by giant fern trees of forty feet in height, whose feathery tops shut out the glaring sunlight, which penetrates everywhere else, you find yourself within gunshot, but can see nothing, for the bird after imitating every note in the bush, which it does in a matchless manner, varied at times, I am told, by sharpening a cross-cut saw, and howling like a dingo, will suddenly spring on to a large fallen tree—that is your chance, but you must be quickness and decision itself, for he does not remain a second without sighting you, and then vanishes like a shadow. On one occasion I had tracked a male bird for nearly a mile by his song, pausing when he ceased, and again advancing when he recommenced his performance; he was running rapidly along when, of a sudden, he sprang on to a fallen tree. I fired at the instant without success, but as I lowered my gun with the despair known only to the deer-stalker and the chamois hunter after a fruitless shot, a voice came from the brush—"Killed? have you killed?" My unknown companion had been stalking the same bird for upwards of an hour without my having the slightest idea of his vicinity, nor he of mine, so noiselessly had we sped along. Shy as the bird is, there have been occasions when I have come suddenly upon them—when, without a gun, at some angle of the road, and then they have eyed me as carelessly as barn-door fowls.

The tail of the male is about three to four feet long; but the Rev. J. G. Wood gives it at ten feet; it consists of sixteen feathers, the two outer being broadly webbed, and from their peculiar shape, giving the name to the bird; the two central are narrowly webbed, and the remainder have long slender shafts bearded by alternate feathery filaments. The female has not the Lyre tail so fully developed as the male, but I have shot old females that have had the Lyre feathers.

The bird very seldom takes wing, once and that only I saw a male bird fly, I had wounded it, and rushing forward to secure my fancied prize, it rose and flew screeching over my head, and into cover about fifty yards. They have a singular habit of scratching circular spots in their haunts, as playing grounds, and go through a variety of antics thereon, imitating the notes of all the birds around.

Lately a live adult has been obtained by the Acclimatization Society of New South Wales, It will be a matter of great interest, to ascertain what success attends the keeping in confinement of this wild bird of the mountain, to whom unlimited freedom would appear to be essential to its existence.

H. RAWNSLEY.

Witton, 1st August, 1863.

PHILOSOPHICAL SOCIETY

OF QUEENSLAND.

A meeting of the Philosophical Society was held on Tuesday, Nov. 3, at which there was a large attendance of members. In the absence of the President, Mr. Rawnsley filled the chair. Various business matters having been disposed of, a letter was read from the Secretary for Lands informing the society that the Government was willing to grant a site for a museum in a very commanding position near the entrance gates of Government House.

A complete list of the papers read before the society was laid upon the table, distinguishing those which had been printed from those which had not. It was resolved that a copy of every printed paper should be filed and kept for the use of the members.

A communication was read urging the necessity which exists for an increase in the number of Meteorological stations in this colony, which gave rise to remarks from various members present as to the utter inutility of only two stations in a territory the extent of Queensland. Remarks were also made pointing out that the value of the observations depend on two circumstances. 1st. Their accuracy. 2nd. Their being taken at stations not too far distant apart, and in places possessing different geographical configurations. It was pointed out by reference to returns laid upon the table, that in New South Wales there were eleven or twelve stations, whilst in Queensland there were only two, both of which were upon the sea coast: at present the various climatic conditions which exist in different parts of the colony are only traditional, and if we are to derive the benefit which it is in the power of science to bestow, we must travel along the beaten track of careful observation, in every locality which presents different climatic features; eventually, the question was ordered to stand over until the next meeting, in order that more precise information might be obtained on the matter.

A present was announced of a case of fossils, collected on the Fitzroy Downs, by J. K. Wilson, Esq., for the Museum in course of formation. It would be well if our colonists generally would follow so good an example. A national Museum is of the greatest importance to a rising community like our own, for here it is that young men must seek the rudiments of the science before they can go out into the world and collect additions to that stock of knowledge which ages have already gathered in. The great question of how soon the bounteous earth we inhabit shall be made to yield up the rich treasures that lie buried in her bosom, depends quite as much, and we shall not go far wrong in saying even more, upon the conquests of science than upon the extent of mere human power which we import from the mother country.

Notice was given that as the next meeting would be the annual meeting, the President would deliver an address, officers for the ensuing year would be elected, and other business commonly reserved for the annual meeting would be transacted. Members willing to fill any of the vacant offices were requested to forward their names to the Secretary previously, that they might be included in the ballot papers.

Mr. Tiffin then read the following paper, which was listened to with the greatest interest, specimens of the rock in its natural state, and also specimens which had been subjected to a welding heat, were used to illustrate the subject.

Of some of the economic uses of the Trappean Rocks around the District of Brisbane.

November 3, 1863.

In consequence of having had what seemed to me a rather singular and valuable discovery brought immediately under my notice, I have ventured on the rather onerous task of attempting to produce a paper for this society. I do so the more willingly, that others may be induced to look upon our Philosophic Society with less awe, and to believe that it is within the province of every member to produce some short memoir of facts or experiments in philosophical subjects which would tend to fan the flame, at least, of science, if it did not open up new walks. The subject of my paper is, perhaps, of too practical a turn even for this society; but our truly scientific men in Queensland are either so few, or so modest, or so secluded, that we have had little benefit from their investigations here—always excepting those of our own members who have come forward—hence the necessity of some tyro to step into the arena (having the temerity to

do so) in order that our society may not languish and disappear completely, after so patient a growth. I purposed to detail "some of the economic uses of the Trappean rocks," and in doing so it would seem a suitable preliminary were I to go back to the origin of the rocks in question.

I would observe here that in my endeavour to ascertain correctly the true nature of this rock, I have felt the want of a geological collection to which to turn and compare the rocks of this district with the figured specimens of the scientific geologists; this want, taken with my empirical and book knowledge of this subject, behoves me to crave the indulgence of the society for the errors I am almost certain to fall into. May I be permitted to express the hope that when the museum, which we have in prospective, is begun, a geological cabinet may be among the first branches that are established?

I believe the Trappean Rocks are considered as next in order after the granitic series, then follow the volcanic; in none of which series do organic remains occur, hence there is no field for the highly important study of palæontology or the science of organic remains among such series of rocks. Yet I find for comfort and encouragement the following remark in Mr. Page's Text Book in reference to the Trap Rocks:—"There is no class of rocks *more puzzling* either to the mineralogist or the geologist, their varieties being so numerous and their relations to the strata being often so intricate and deceptive." However if I am not greatly deceived, the masses of variegated rock which crop out on both sides of the Brisbane River and in various parts of the suburbs of Brisbane, are Trappean Rocks, and bear the distinctive characteristics of *claystone-porphyry*. That the rock is porphyritic there is little doubt, by the presence of spar-like crystals throughout the various masses, and much of it has also the purple colour of porphyry; and that it is a claystone there seems little question, as when breathed upon, it emits the argillaceous odour peculiar to clayey substances, such as pipeclay, &c. This odour is frequently perceivable during a shower while passing along a road "metalled" with this stone. When looking at the formation of this rock in a quarry, it appears like a closely compacted mass of the raw starch of commerce. It has apparently been originally in the form of a thin clay puddle, interspersed with crystals of felspar and the other components of of granite, containing even particles of clay slate, which have been held in suspension in the fluid or semi-fluid mass, and in this state subjected to a fervent heat (possibly by water raised to an extraordinary temperature, which suddenly drove off the moisture, leaving the substance slightly vesicular and the crystals very generally distributed throughout. The process of cooling, which seems to have been gradual (for the rock is not hard and crystalline like the basalts) has given the columnar structure—like starch—which we see in the quarries, and the joints are frequently found filled with a much harder substance than the body of rock and not unlike ironstone, probably an aqueous deposition of ferruginous matter.

It is worthy of remark that clay after it has been washed and run into a fine puddle, dries into masses much resembling this rock *in situ*, and the raw starch before mentioned. If the foregoing description be the correct one of the origin of this trap rock, and from the experiment which I am about to relate, I have reason to think it is, there is no doubt that we have one of the most useful rocks in this and many other districts—for it extends to my knowledge, to the Wide Bay Range, at least—that the world possesses.

The experiment I refer to was made accidentally by a brickmaker at work near one of the quarries beyond York's Hollow, who procured a quantity of the borings from the blastings in the quarry, and converted them, being a fine powder, into ordinary bricks by the usual processes of tempering and moulding. The brickmaker assured me that no other material was used in their manufacture, except the sprinkling of sand in the mould. I produce the bricks made from this material, which I consider are evidence that the rock is argillaceous in its nature. It is necessary to state that these bricks are only hand made, not pressed. They will prove invaluable as the colony gets developed, for furnaces, pavements, and very strong and permanent buildings, for they are not porous, nor are they liable to disintegrate by the action of moisture, as the stone in its natural state is. And they are certain to be fully twice as strong, in consequence of their compactness, as the native rock or as ordinary brick, although I have no proper means of testing this quality in them. Their weight is 8·621 lbs. compared (in size) with common brick which weighs 7·00 lbs.; with sandstone 10·91 lbs., and with the trap rock itself, which weighs 8·82 lbs. Their weight, taken into account with their extreme hardness, is a fair test of their probable strength to resist compression. Some persons may doubt as to the possibility of crushing such a hard material, but I need only remind them of the wonderful perfection of quartz-crushing machinery now; besides I have little doubt but that a very little extra cost on to an ordinary horse-puddling machine would be found adequate for the thorough pulverisation of this material.

To enumerate some of the known uses of this rock, I would mention its adaptability as a building stone, either in its rough or hewn shape, its value as a road material, either as pavement, channelling or for the purposes of macadamising, or for ballasting railway lines; which are frequently ballasted with clay burnt for the purpose; and lastly, its convertibility into the bricks already described and shown.

A similar stone has been used by ancient

nations, and even within a short period in England, as a fire stone; and in Assyria and India, it has been extensively used for sculptural purposes. If I mistake not, the celebrated sculptured *bas-reliefs* brought to light by Layard in the ruins of Nineveh and Persepolis are of this porphyritic stone, and they are as fresh now as they were when carved 2000 or 3000 years ago.

It is stated in reference to trap districts that "they are synonymous with amenity and fertility," and I think that this fact taken into consideration with the prevailing geological character of this district—seemingly the new red sandstone, superimposed as is usual, on the carboniferous system, is the cause of the universally expressed opinion of the extreme natural beauty of the scenery on the river Brisbane, its unusually verdant and luxuriant appearance and of the great value of the soil for producing vegetable products, when supplied with a due proportion of ammoniacal ingredients in which it is generally wanting; facilities of drainage through the natural fissures of the bed rock being not the least of the advantages possessed by trap formations; the surrounding hills, on which rest the suburbs of Brisbane, being practical illustrations of the rapid drainage of the soil, and the well-tended and manured gardens, sufficient evidences of its capabilities.

I fear that, although my subject is exhausted in this short paper, I have gone over a great deal of old ground, and stated many stale and trite facts known to every intelligent reader. Yet if this attempt of mine, in the widest field of human research, be but an incentive to others who have studied the subject systematically, we may hope to make a commencement in Queensland with the geological history of the colony, which has, yet, had but a cursory glance and an imperfect and unfinished outline from only one or two known geologists. There is little doubt that were a good geologic map laid down of this colony, that no country could vie with it in the variety and value of its strata and of its physical conformation generally.

The Essayist having concluded, many questions of interest on this important subject were asked and answered, after which the meeting separated.

THE

ANNUAL REPORT

OF THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

1863.

WITH

THE PRESIDENT'S ADDRESS.

BRISBANE:
PRINTED BY G. WIGHT, "GUARDIAN" OFFICE.

OFFICERS FOR 1864.

PATRON:

His Excellency Sir G. F. Bowen, K.C.M.G., &c.

PRESIDENT:

His Honor Chief Justice Cockle.

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Charles Coxen, Esq., M.L.A.

TREASURER:

Alexander Raff, Esq.

AUDITORS:

Rev. R. Creyke, B.A. | E. Macdonnell, Esq.

COUNCIL:

Sylvester Diggles, Esq.,

H. C. Rawnsley, Esq. | Rev. J. Bliss.

Charles Tiffin, Esq. | Rev. B. E. Shaw.

SECRETARY:

Rev. J. Bliss.

QUEENSLAND

PHILOSOPHICAL SOCIETY.

ANNUAL MEETING HELD ON TUESDAY, DECEMBER 1, 1863.

(From the *Daily Guardian*, December 2, 1863.)

The Annual Meeting of the Queensland Philosophical Society was held on Tuesday, in the Municipal Chambers, kindly granted for that purpose. There was a fair attendance of members notwithstanding the inclemency of the weather. His Honor Chief Justice Cockle, President of the Society, occupied the chair.

The minutes of the last meeting of the Society were read and confirmed.

Three new members were balloted successfully for, namely, Mr. J. Douglas, Mr. N. Bartley, and Dr. Lansdown. The members of the society present in connection with a remark made by Mr. Bartley, thought that Government might be disposed to render some assistance in collecting the meteorological observations from several parts of this large colony; and that gentleman was requested to prepare a paper on the subject, to be read before the next meeting. It was resolved to open communications, and when practicable to exchange papers with similar societies in the Australian colonies, Tasmania, and at home;—namely, the Royal Society of Victoria, Philosophical Society of Sydney, and similar societies in Tasmania and Adelaide; the Royal Society, London, the Royal Society, Cambridge; the Royal Irish Academy; and the Royal Asiatic Society, Calcutta.

The following interesting communication was read by the Secretary, the Rev. J. Bliss, from Sir Redmond Barry:—

Melbourne Public Library,
27th October, 1863.

Sir,—In reply to the enquiries which you have done me the honor to address to me respecting the nature, constitution, and management of the Melbourne Public Library, of which I am one of the Trustees, it gives me much pleasure to afford you all the information which I possess; that consists in this, namely,

The Trustees laid it down, as a first principle, that the monies to be employed by them should be expended carefully and economically in the purchase of standard works (and none other) on the most important and useful branches of History, Literature, Science, Art, and Polity, admitting no works of a trivial or ephemeral character, which serve merely to dissipate the idle hours of the lounger, or, as far as they can be excluded, works having injurious tendencies.

Next, the Trustees admit to the Library from 10 a.m. to 10 p.m., without any necessity for introduction or letter of recommendation, all classes of the community; and they permit every visitor to enjoy full freedom of action in the selection of authors for his study, in the number of works which he may desire to consult, and in the length of time he may wish to retain them in the reading-room. An adherence to these simple rules has been, in my opinion, the cause of the progress which you are pleased to consider as having been so successful; for experience has abundantly proved that there is no greater mistake than to undervalue the degree of intelligence possessed and education attained by the people of this country (as well as of those adjacent), and their ability to appreciate what expands and invigorates their intellectual powers. And, at the same time, that mere formal liberty of admission degenerates into a useless and irritating obstruction, and that the restraints (common elsewhere) upon the free use of books entail expense in management and loss of time and perplexity to readers, without securing the protection to the property, or the other sup-

posed advantages which the system was invented to attain at times very different from the present, and under circumstances totally dissimilar.

The Trustees are at present engaged in enlarging the building by an addition of a wing, which will give an extension of ninety-five feet to the principal reading-room up stairs, making the whole length two hundred and forty feet, and afford space in the apartments on the ground floor for the more convenient display and illustration of the works of art in the museum.

When this wing is finished the arrangements may be rendered more in harmony with the contemptated plan of distribution of the various branches of literature in different parts of the reading-room, and a chamber may be set apart for the use of these desiring to make extracts, etc., etc., and for professional men and students of art to investigate and take copies from the valuable collection of works in the possession of the Trustees.

In like manner members of the other learned professions will have their places of study free from the interruption of such persons as would only inspect the professional works from motives of purposeless curiosity.

Substantial proofs of the soundness of the principles by which the Trustees have been guided are afforded by the numbers of readers in the library, and visitors to the Museum of Art (the latter of which is still in a rudimentary state, crippled through want of space) by the constant and increasing demand for works of a high class in art and science, by the uniform regularity of conduct and propriety of demeanour on the part of those who frequent the institution, by the rare and exceptional instances of the abuse of the privileges of which the public is invited to partake, by the trifling injury to the valuable property, which during seven years does not exceed in money value ten pounds, and by the avidity which is displayed by the inhabitants of the inland towns to take advantage of the loan system, under the regulations of which three or four hundred volumes are lent for three or four months to Mechanics' and Literary Institutions, on condition that the same freedom of access to them is afforded in the buildings of the borrowers as in the parent establishment.

This latter mode of proceeding has in a degree materially improved the sympathy of residents at a distance for the library, as they can now participate directly, without leaving their homes, in the benefits which formerly could only be gained by a visit to the capital. It has moreover associated these different institutions with that of Melbourne, like (as it were) adult colleges for voluntary self-instruction in affiliation with the central adult university.

For my own part I am deeply impressed with the great importance of such institutions, judging from the short retrospect, it may well be hoped that they will insensibly produce that self-asserting influence which flows naturally from the acquisition of sound learning, high mental culture, and the consequent refinement so indispensable to regulate the mobility and fickleness of young communities. A proper direction being given in them to public thought, instruction is imparted without obstruction, dictation or interference with the natural bent of mind, or peculiar inclination of individuals.

From these foregoing remarks you may expect to hear that the rules published by the trustees are few and simple, and you will find them in the preface of the catalogue, a copy of which I forward to you.

It will give me much satisfaction to hear that a public library is established in Queensland; it will reflect much honour upon your Philosophical Society if it be instrumental in persuading the Government to devote a portion of the revenue to a purpose so legitimate, so enlightened, and one so likely to be productive of the best practical results.

It will be provident (if I may be permitted to make the suggestion) to request if it be not already too late, that a piece of land of moderate size be reserved for the erection of a suitable building; four or six acres would suffice; and in selecting the situation, regard should be had to central position, convenience of access, elevation of site, freedom from noise and dust, and attention paid to other considerations relating to drainage and health which your acquaintance with the locality will indicate.

If at any time you desire any further information in my power to impart, I will be ready to reply—meanwhile wishing you the fullest measure of success.

I have the honor to be,
Sir,
Your obedient servant,
REDMOND BARRY.
One of the Trustees of the Melbourne Public Library.

Mr. Coxen moved, and Mr. A. Raff seconded, that the thanks of the Society be given to Sir R. Barry for his valuable communication.

The Rev. J. Bliss, Secretary, then read the

Report.

In presenting the Annual Report in this the fifth year of the Society's existence, the Council trust that it may now be safely looked upon as one of the permanent institutions of the colony. There are many dangers to which all societies are exposed in their earlier stages, and particularly is it so with our own, for in a population so small and widely scattered the number of persons likely to take an active part in its proceedings must necessarily be limited.

During the year, the number of members has increased, and the monthly meetings have been

held with unusual regularity, whilst the increased attendance at each of them seems to indicate that members are more alive to the beneficial influence the Society is calculated to exert in the spread of scientific pursuits amongst us.

Four valuable papers have been read before the Society, viz.:—

1. On the Anglo-Australian Telegraph—by J. J. Austin.

2. On Insects whose productions are useful to man—by S. Diggles.

3. On the Menura Superba—by H. C. Rawnsley.

4. On some of the economic uses of the Trappean Rocks around this district—by C. Tiffin.

The Council have to report an important alteration which has been made in the constitution of the Society. In the month of June a letter was received from his Excellency Sir G. F. Bowen, pointing out that it would be for the benefit of the Society to have for its President a gentleman permanently resident in the colony, with leisure to devote to its interests, and, with a view to accomplish this object, offered to resign the office he then filled. Hereupon, a general meeting was convened to consider his Excellency's proposition, when the office of Patron was added to those already existing. His Excellency has been pleased to accept of the same, in the place of that which he formerly held. In filling up the office of President thus vacated, the Council congratulate the Society on the election of his Honour Chief Justice Cockle.

In the last Annual Report, suggestions were thrown out that the Society should take steps to procure a site for a library and museum. After mature deliberation and a long correspondence with the Secretary for Lands, a very eligible site has been granted near the entrance gates of the Government domain, possessing the essential qualifications of being isolated from other buildings, and whilst out of the reach of dust and noise is readily accessible to those who may desire to consult its contents.

During the year, some additions have been made to the collection already possessed by the Society. Two valuable cabinets of entomological specimens have been obtained, and the thanks of the Society are due to Mr. Diggles for the labour he has expended in arranging them, and for his liberality in supplying many specimens from his own cabinets, in order to make the collection more complete. Two cases of British birds, and some marine specimens collected in Moreton Bay, are amongst the additions that have been made.

The Council has also to acknowledge with thanks a case of fossil remains, collected on the Fitzroy Downs, and presented to the Society by J. K. Wilson, Esq., and they take this opportunity of pressing upon members the duty of adding to the collection, both by their own personal efforts and through the assistance of their friends. It would be well to keep in view the fact, that a public museum offers a safe repository for valuable collections, which too often perish from want of care, or from being in private possession, are lost to many who would desire to consult them.

It is necessary to refer with deep regret to the loss of our late secretary, Dr. Barton. It should be remembered that he, together with two or three others, were the founders of this Society, and his patience and solicitude in everything connected with its welfare, demand special recognition at our hands.

Mr. J. J. Austin has likewise been removed by death, whose name will be remembered in connection with a valuable paper on the Anglo-Australian Telegraph, which was read before the Society—on which occasion his Excellency the Governor occupied the chair, and took part in the discussion that followed.

Our Society having now assumed a permanent place amongst similar institutions, it has been thought desirable that our rules should be made to harmonize as nearly as possible with those of older and more important societies in England. With this view, a revised code of rules, based upon those of the Cambridge Philosophical Society is in course of preparation, and will shortly be submitted for the consideration of the members.

The funds of the society, as will be seen from the Treasurer's balance sheet, have been very limited, which arises chiefly from the circumstance that the promise of an annual grant of £100, made by the Government last year, was retracted at a period of the Parliamentary session too late to admit of further application being made. The revenue, therefore, of the society has been limited to the subscriptions of the members.

CHARLES COXEN, V.P.

The adoption of the report was moved and seconded by Mr. Le Gould and Mr. Raff.

His Honour James Cockle, the Chief Justice of Queensland, and President of the Society, then delivered the following—

ADDRESS.

I do not know that, even if circumstances had permitted me to prepare a more elaborate address, I could on this occasion add much to the Report of the Council. Honoured I cannot but feel in having been thought worthy of succeeding to the chair lately occupied by His Excellency the Governor. I say this, not so much on account of the lustre which his pre-eminent position in the colony may be supposed to have thrown round the office, as having regard to that literary eminence which of itself justified the choice of the Society, and to the signal advantages which will accrue to the colony from the part which our first President has taken in the work of education. In times to come, when the man of scholarly habits shall desire to animate the indifference

or inspire the energies of the tardy in this great work; when the man of trained intellect shall seek to refute the fallacies of those who decry intellectual cultivation as a something inconsistent with practical ability; either will find in the address lately delivered by His Excellency at Ipswich an armoury of topics and arguments, and, better still, will be able to point their lesson with the practical illustration furnished by the career of SIR GEORGE FERGUSON BOWEN.

The Council has paid its tribute to the memory of Dr. BARTON and of Mr. AUSTIN. The record of, as it were, the dying words of the latter on our proceedings ought not to remain unstudied. His paper on the Anglo-Australian Telegraph is important in a scientific point of view, in its relation to the welfare and prosperity of Queensland and Australia in general, and, moreover, in respect of the illustration which it affords of the intimate nature of the union which subsists between the theoretical and practical. The labour of the experimenters, and the studies of the sages, are not the mere diversions which some would represent them to be. Without them Austin would not have been able to unveil the prospect of communications to be had with England in sixteen days—days capable, when telegraphic communication is established between Egypt or Asiatic Turkey and India, of being reduced to hours. "By availing herself of the circumstances within her reach," says Austin, "Queensland may hereafter become one of the greatest of the Australian colonies in prosperity, wealth and influence."

On such an audience as that which I have the honour of addressing, I need not enforce the importance of all knowledge, of every description of mental cultivation. But when, as we peruse Austin's paper, we reflect that man, using a wire as a speaking trumpet and the subtle agencies of nature as breath, can transmit from one end of the earth to the other, and with almost incredible speed, the expression of his hopes, wants, and sympathies, of his commercial exigencies and his political requirements, a feeling of gratitude, as well as of admiration, ought to animate us with regard to those who have contributed to such achievements. Let us, however, be cautious lest we allow results like these to induce us to demand in all cases some immediate practical deduction from scientific labours. Such a deduction it may not be possible in all cases to give, and yet the labours may be practically valuable. The conical pendulum was a speculation in the hands of Huygens, but it was applied by Watt to the construction of the "governor" of the steam-engine. Albert Girard's theorem for the spherical excess was with him a speculation, but General Roy at Dalby's suggestion successfully applied it during the great trigonometrical survey of England or Great Britain. In the time of Kepler and Newton the properties of the ellipse and parabola, known as far back as the days of Apollonius, were seen to be necessary for astronomical purposes. "The time is coming," says De Morgan, "when really learned men will again be ashamed of not seeing the value of all the uses of mind: when nothing but thoughtlessness or impudence, mercurial brain or brazen forehead, will aver that no knowledge is practical, except that which ends in the use of material instruments."

The mission of such a Society as ours is to promote the spread of knowledge of all kinds. And this may, and I trust will, be done in two ways: first, by the direct contributions of its members to the body of knowledge; secondly, by suggesting or fostering plans for the diffusion of knowledge as it exists. That it will not be wanting in the first the papers of Mr. Rawnsley, of Mr. Tiffin and of Mr. Diggles, mentioned in the report, afford an earnest of. Nor will it be found wanting in the second: for steps have been taken by the Society which will probably contribute efficiently to the establishment of a Public Library and Museum.

That such establishments are desirable few, probably, would be disposed to dispute. But, it may be asked, would their utility be such as to justify the expenditure which would be incurred, regard being had to the circumstances of the colony? I am in a condition to answer this query not merely by general arguments (for which I have now no time to seek), but by an appeal to experience. One of the greatest men who has yet appeared in this part of the world, a man of whom Victoria may well be proud, the Chancellor of her University, and the friend and patron of aught that can promote her progress, has favoured Mr. Bliss with important information respecting the Melbourne Library. The letter containing it will, I trust, be published in its entirety. It embraces matters of detail that will be found invaluable when the projected institution is approaching accomplishment. But the portion of it which more immediately concerns us this evening is the statement that, "experience has abundantly proved that there is no greater mistake than to undervalue the degree of intelligence possessed, and education attained by the people of this country (as well as those adjacent) and their ability to appreciate what expands and invigorates their intellectual powers." Couple this statement with a fact which appears among others in the margin of the letter, viz., that there were upwards of two hundred thousand visitors to the Melbourne Library in 1862, and we shall be able to surmise whether a Library and Museum would not be esteemed a boon at Brisbane. I care not whether the above number signifies the number of visits or that of visitors. It sufficiently appears that the institution is one of public value. The letter recommends that a piece of land of the size of four or six acres should be reserved for the like purpose at Brisbane. I have dwelt upon this letter be-

cause it emanates from one whose judgment in such matters sufficiently appears, from the example of Melbourne, to be a sound judgment; and I cannot quit it without uttering the hope that all the honours with which a grateful country rewards an able public servant may be showered upon Sir Redmond Barry.

For the rest I trust that the Society may receive an influx of members and an extension of influence; and that it may be recognised as —what indeed it is—the germ of an institution of permanence and public importance. It will welcome communications on any scientific subject, or on the history of such subjects.

In fact, their own peculiar results do not constitute all that ought to be known of the sciences. Philosophy and History demand of each, and of each other, a characteristic contribution. In disregarding the claims of either, we may ignore truths pregnant with interest and instruction.

It is not merely for the light which the beacons of the past can throw on long forgotten trains of thought, nor even for the sake of illustrating collateral events or tracing the path of human progress, that they are so assiduously rekindled. Awakening the imagination, clearing and warming our conceptions of vanished ages, their lustre is not without influences which may for some minds have a greater charm.

Scientific History teems with salutary depictions. It brings before us conspicuous instances of a genius, industry, and striving after truth; of talent misapplied; of wisdom, now pursuing a phantom, now sowing ideas in which, unappreciated by contemporaries and deemed barren in their day, we trace the germs of harvests which after times have abundantly reaped. History preserves all, as examples or as warnings. The unsuccessful labours of the past may be landmarks for the present.

The proper exercise of his high functions confers dignity as well as usefulness on the labours of the historian. He purifies science by the censure which he brings down on negligence and disingenuousness, on ill-regulated speculation and misdirected energies. He secures to merit that applause which is often its best encouragement, and, too often, its only reward.

And now, gentlemen, I must conclude, with a hearty wish for the prosperity and progress of the Society.

Mr. Wight proposed that the address of the President be embodied in the printed proceedings; seconded by the Rev. B. E. Shaw.

It was stated that Mr. J. K. Wilson, Blithesdale, Firtzroy Downs, had sent to the Society through Mr. T. Warry, a box of fossil bones. The skull of an albatross and the jaws of a shark were presented to the Society by Mr. Danvers. Mr. Le Gould placed on the table some vegetable curiosities, which will be more fully described in a short paper in the course of a month or two.

The business of the meeting terminated with the appointment of the following office-bearers and council:—His Honour the Chief Justice Cockle, President; Charles Coxen, Esq., M.L.A.. Vice-President; A. Raff, Esq., J.P., Treasurer; Rev. R. Creyke and E. Macdonnell, Esq., Auditors; Council of Five—S. Diggles, Esq., H. C. Rawnsley, Esq., Rev. J. Bliss, Charles Tiffin, Esq., and Rev. B. E. Shaw.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

THE Queensland Philosophical Society held its ordinary monthly meeting (January 5th) in the Municipal Chambers. Charles Coxen, Esq., M.L.A., Vice President of the Society, occupied the chair, in the absence of his Honour the Chief Justice, who is on circuit at Ipswich. When a portion of the business had been transacted, Mr. Coxen vacated the chair, owing to his presence being required at another meeting, and Mr. Rawnsley occupied the chair till the close of the meeting.

The minutes were read by Mr. Diggles, in the place of Rev. John Bliss, Secretary, who was from home, and were confirmed.

Mr. RAWNSLEY proposed, seconded by Mr. DIGGLES, that the Secretary be instructed to convey the thanks of the meeting to his Worship the Mayor, for the use of the Council Chambers to hold the monthly meetings.

In the absence of Mr. Coxen, Mr. DIGGLES brought forward the question of the change of evening on which the society should hold its meetings. After a somewhat lengthened conversation on the subject, it was resolved to postpone the settlement of it till the attendance of the President and certain other members, whose arrangements might be affected by the proposed alteration.

Mr. DIGGLES proposed that Mr. Gordon Sandeman, and Mr. LE GOULD proposed that Mr. Andrew John Baden Jenner, should be balloted for next meeting of the society.

Mr. MACDONNELL asked the President whether the collections in the society's temporary museum were in good condition, and whether any steps had been taken in regard to the buildings on the site granted to the society for their use?

The CHAIRMAN (Mr. Rawnsley) stated that nothing had as yet been done in that matter, as trustees had not yet been appointed—a defect which he hoped would soon be removed.

Mr. DIGGLES and Mr BARTLEY both expressed their belief that the society's specimens in the Windmill Tower are in excellent state of preservation.

The question of the trusteeship was taken up by the meeting, and fully discussed. It was ultimately proposed by Mr. MACDONNELL, and seconded by Mr. LE GOULD, that the President, the secretary, and Mr. Wight be appointed a committee to wait on the Minister for Lands and Works, to confer on the question of the trustees, and report to next meeting.

Several specimens of gold and of silver were placed on the table, for the examination of the members. The specimen of silver, and one of gold, were from Mr. Gordon Sandeman; the others were from Mr. MacDonnell, among which was that large nugget, fully described in the *Guardian* yesterday, and at present on view at Mr. MacDonnell's (Flavelle Brothers) Queen-street.

Mr. LE GOULD who had prepared a paper on the Geology of the Colony, handsomely postponed the reading of it in favour of the following valuable paper by Mr. Bartley:—

COMPARATIVE METEOROLOGY.

The science of meteorology has only of late years received that amount of attention and study requisite to make it useful as well as interesting. It is as yet, however, only in its infancy; and in order to form an idea of its real importance, we must exercise the imagination a little, and endeavour to picture to ourselves what the result would now be if, during the last hundred years, every portion of the earth had had its meteorological peculiarities carefully noted, recorded, and *compared* with those of other parts. What a sum total of

valuable knowledge would have been the consequence!—what a climatic map of the world!—anticipating, and superseding to a great extent, the experimental labours of the lovers of acclimatisation. We should then know that which now we are ignorant of, viz., which distinct and distant portions of the globe assimilate to each other in temperature, rainfall, prevailing winds, electricity, atmospheric pressure, dryness or dampness of the climate, the length of the various seasons, and the causes and effects of exceptional seasons, as observed in a cycle of years, &c., &c. We should be able to judge of the fitness, or otherwise, of each place for the support of life, either in the human race in health and disease, or in the case of animals, birds, fish, or plants. We may infer with tolerable safety, for instance, that the salmon will thrive if introduced into the waters of any country similar to Scotland; or the sugar-cane will flourish in any place with a climate like that of Demerara. The converse of these conclusions must also obtain—that where any natural production fails or is sickly, the same result would follow in its being introduced into a similar climate elsewhere, and the trouble, danger, and expense of the experiment would be obviated and rendered unnecessary.

The uses of meteorological observations in foretelling the advent of sea-storms and their movements from one part of the coast to another, form an additional and strong argument in favour of extending our fields of research and record under this head. The electric telegraph comes to our assistance here and renders available for prompt application, those facts which must otherwise have been of mere ordinary utility in the usual quiet way of record.

The study of planetary influence on the weather becomes also necessary in order to embrace the whole subject successfully, inasmuch as many phases of the weather would be quite unaccountable if the causes were looked for on the earth alone.

The importance of making and keeping up these observations is fully recognised by the Home Government. The Board of Trade has obtained from Parliament an annual grant for carrying out this object; but we need not look so far from Australia in order to find due attention paid to these matters, at least so far as the record of temperature or rainfall is concerned. Since the year 1842, at Melbourne, Adelaide, Hobart Town, and Port Macquarie these observations have been made and kept, and at Sydney for a much longer period. In New Zealand also, for many years past, regular records of the weather have been carried out at Auckland, Wellington, New Plymouth, and elsewhere.

In New South Wales there are more than a dozen stations for weather record; one is established at Armidale, on the table land of New England; another at Cooma, on the high country of Maneroo; also at Deniliquin and Albury, in the Murray district; at Goulburn and Bathurst, each in mountain districts; Casino, on the Richmond River; Maitland, Parramatta and Braidwood, on the Clyde River ranges, &c., &c. The result of the observations made at these stations is interesting in a high degree, and as there are both hotter and colder places in New South Wales than any of those named, we find that that colony possesses within its borders climates varying from that of Scotland to that of Africa, and this, too, without any Himalayan elevations.

The subjoined list shows at a glance the annual mean temperature of many places in Australia, interspersed with those of similar climates in Europe, America, Asia, &c. There is also a comparison, month by month, of the climates of London, 51 degrees north, 70 feet above sea level; Armidale, 30 degrees south, 3258 feet above sea level; Cooma, 36 deg. south, 2637 feet above sea level; and Hobart Town, 43 deg. south; and showing how much more rapidly spring comes on in Australia as compared with England, while the annual mean temperature of the four places is after all so similar.

Latitude.		Annual Mean Temp.
11·55	Pondicherry, E.I.	83·75
11·5	Port Essington, Australia...	82·8
10·27	Cumana, S.America ...	81·86
1·20	Singapore	79·0
6·10	Batavia	78·3
23·10	Havanah	78·08
19·11	Vera Cruz	77·72
22·23	Calcutta	77·6
14·36	Manila	77·45
23·0	Rockhampton	74·5
	Rio Janeiro...	74·0
30·2	Cairo	72·32
	Algiers	70·0
27.1	Brisbane	67·9
	Port Natal, S.Africa ...	67·9
	Madeira	67·9
	Casino, Richmond River, N. S. Wales	66·5
31·55	Western Australia	65·3
	Cape Town	65·0
34·55	Adelaide	64·9
	New Orleans	64·76
	Cadiz	63·5
31·25	Port Macquarie	63·0
32·47	Maitland	63·0
43·7	Toulon	62·06
33·51	Sydney	62·0
	Lisbon	62·0
	Naples	61·0
32·45	Nagasaki, Japan	60·80
	Rome	60·44
35·2	King George's Sound ...	60·1
	Nice...	60·0
43·36	Montpelier	59·36
43·17	Marseilles	59·0

Latitude.		Annual Mean Temp.
36·6	Albury, N.S.Wales, 572 feet above sea	58·5
35·32	Deniliquin, 410 feet above sea	58·2
41·17	Wellington, N.Zealand ...	57·9
38·18	Melbourne, 40 feet above sea	57·6
36·51	Auckland, N.Zealand ...	57·1
39·4	NewPlymouth, N.Zealand...	56·8
44·50	Bordeaux	56·48
45·28	Milan	55·76
33·24	Bathurst, N. S. Wales, 2333 feet above sea	55·4
34·45	Goulburn, 2129 feet above sea	53·8
	New York	53·8
39·56	Philadelphia	53·42
30·34	Armidale, N. S. Wales, 3258 feet above sea	53·40
42·53	Hobart Town	53·3
41·30	Launceston...	53·2
	Bath, England	53·0
50·50	Brussels	51·80
52·22	Amsterdam...	51·62
36·13	Cooma, N. S. Wales, 2637 feet above sea	51·2
48·50	Paris	51·08
51·30	London	50·36
48·12	Vienna	50·54
	Geneva	49·3
53·21	Dublin	49.10
52·14	Warsaw	48·56
55·57	Edinburgh...	47·84
55·41	Copenhagen	45·63
46·47	Quebec	41·74
59·20	Stockholm	42·26
55·45	Moscow	40·10
59·56	St. Petersburg	38·84

Cooma.		Armidale.		London.		Hobart T.	
Jan.	65·0	Jan.	64·2	July	63	Jan.	62·1
Feb.	59·4	Feb.	63·0	Aug.	63	Feb.	61·4
Mar.	61·4	Mar.	59·8	Sep.	58	Mar.	58·9
April	54·2	Apr.	53·8	Oct.	51	Apr.	53·2
May	44·2	May	47·0	Nov.	42	May	49·3
June	39·4	June	43·4	Dec.	38	June	45·3
July	37·7	July	37·5	Jan.	36	July	43·7
Aug.	41·2	Aug.	45·4	Feb.	39	Aug.	46·0
Sep.	45·7	Sep.	48·7	Mar.	42	Sept.	49·9
Oct.	51·3	Oct.	57·0	April	47	Oct.	53·1
Nov.	54·7	Nov.	60·6	May	56	Nov.	57·6
Dec.	60·4	Dec.	64·6	June	60	Dec.	61·1

The climate of Hobart Town compares very favourably with that of London ; for while the summer heat is exactly the same, Hobart Town is seven degrees warmer in winter than London, which is more to be accounted for by the influence of the sea than by any difference in latitude.

This is a formidable array of figures, but my excuse for furnishing it must be that I wish to point out how well Australia deserves all the praises that have been bestowed on her climate. The temperature of the medium latitudes of Australia is precisely that of those favoured spots on the Mediterranean and the neighbouring ocean, which are the chosen places of abode of those people, whose wealth enables them to select from all Europe where they shall reside, and whose refined taste, if not already fully known, would be amply confirmed by their choice in this respect. I allude to such places as Naples, Nice, Rome, &c.: neither St. Petersburg nor Pondicherry would be places of choice to live in. No part of Australia at present settled approaches the extreme of either.

In contrast with this, what we know of the climate of Queensland is little indeed ; we know certainly that Cape Moreton climate is more equable than that of Brisbane, and that Gladstone, with its south-east trade wind enjoys a cooler summer than Brisbane does ; and we know also from Sir Thomas Mitchell's observations that in the interior of the colony the heat varies from 125 deg. in the shade in summer, down to 10 deg. at night in winter even in the tropics ; but we require to know more than this ; we require something definite and reduced to figures about the climate of Darling Downs, the Burnett table-land, the Peak Downs, and other places in the interior, as well as on and near the sea coast. We want to know where wheat will thrive best, and where sugar ; we want to know to what part of the colony our new arrivals had better direct their steps in search of health or wealth, with the best prospect of securing either.

It must not be forgotten that the grand ultimate object of all these observations is collation and comparison at some head quarter (either in Europe or Australia) of the whole. In this manner the result of the dispersed labours of the many may be brought together and digested into a practical and useful form, and made available therefor by the experienced skill of some superior master of the science.

The terrible storm of October 1859, generally called the "Royal Charter" storm was preceded and accompanied by various abnormal atmospheric symptoms, which has been discussed in full by scientific men. The still more violent and fatal storm of January, 1839, raged at its worst, at very nearly the same spot ; on this (Sunday) morning the Pennsylvania, Lockwoods, and St. Andrews, and many other vessels left Liverpool, but only to come ashore again at night on the shoals at the mouth of the Mersey. I have not met with any observations of the weather taken at or before this cyclone, but *as* it was certainly the most violent in England within the present generation, the accompanying disturbance of the atmosphere must have been well worthy of note and record.

The great storm of 1703, and that in which the Eddystone Lighthouse was destroyed, might have furnished interesting data to the meteorologist, but, unfortunately, at that time,

seafaring men, with a few honourable exceptions, as Dampier and others, either failed to observe, or at all events to make record of what they might have. I allude to these storms, because it is on occasions like them that rare opportunities for observations and record present themselves. The atmospheric symptoms and disturbance, both before and at the time of the cyclone, are strongly marked, violent, and beyond all possibility of dubiousness. No room is left for conjecture or speculation, and then is the time to store up information for future use. Thus, if all similar storms, previous to the 1839 one, had been duly marked, the doomed ships would never have left port, and no lives nor property would have been lost. To turn awhile from the consideration of the weather as it affects the seafarer to that portion of the subject more immediately concerning the agriculturist especially in the colonies, viz., the rainfall. This is a matter that has been more or less carefully recorded in New South Wales since the year 1788. This was a year of drought; Captain Flinders, from 1782 to 1792, found traces of drought, and bush fires, wherever he landed on the coasts of Australia. In 1797 a severe drought visited Westernport, near the future site of Melbourne. A change now set in, and in nearly every year from 1799 to 1806, there were high floods. The Hawkesbury rose 101 feet at the town of Windsor; wheat rose to 80s. a bushel, and there was almost a famine in the colony. These floods continued, more or less, till 1810, when a drought set in, and in 1811 water was sold at 6d. a bucket-full in Sydney. From this date, until 1826, the floods were more prevalent, at all events thought more worthy of record than the drought, the Hunter River rising 37 feet in 1820. However, from 1826 to 1829 the weather was again dry, and formed the most fearful and long continued drought that has afflicted Australia since it was settled, and fourpence a gallon was paid for water in Sydney during 1829. In 1830 was the first great flood for eleven years, and Windsor, on the Hawkesbury, was again a small island for the time being. From this date, however, dry weather again set in, and after several years of more or less dry, commenced the terrible drought of 1838 and 1839, which almost exterminated the stock of sheep and cattle in the colony, and dried up the great Murrumbidgee itself, killing the fish, which putrefied in the bed of the river. This was followed again by floods, which in 1841 made their appearance in Moreton Bay, as well, raising the Bremer 70 feet, on which occasion the feat of swimming from Ipswich to Brisbane was performed by a man who came with a letter asking for relief for the Government station there; this flood rose twenty-five feet higher than the 1857 one. From this time till 1850 there was rather a superfluity of rain on the whole; but 1850 was all but a rainless year, and the noted Black Thursday of February, 1851, was nearly the closing scene of that drought. Floods again became the order of the day, and in 1852, in the month of June, occurred the one that swept Gundagai away. I will not follow the records any further, as from the date last named the seasons are almost a matter of memory with us in Moreton Bay, and although we do not suffer from the extremes and long duration of them that New South Wales does, we still have had our share of drought and flood since that time.

I have been thus lengthy on this part of the subject, in order to illustrate what has been learnt of the cycles of wet and dry years in New South Wales for the last eighty years.

The result of these observations (for which I am indebted to an article by Mr. Jevons, of Sydney,) appears to be that the seasons in Australia run in alternate wet and dry cycles of about twenty years each, that is to say for twenty years more or less there will be a few floods, but long and severe droughts will be the prevalent form of weather—the floods being neither long nor heavy. Again, in the wet cycles the floods, though interspersed (so to speak) with drought, will be the prevalent weather, being both frequent, long-continued, and heavy—the droughts being few, short, and comparatively trifling. The last cycle of *dry* weather found a termination about the year 1840, since when there has been but one serious drought. We may look now, therefore, for an early setting in of weather more remarkable (for very many years to come) for drought than flood, that is, if past experience be any guide or test as to the future.

Herein is seen the great distinction that marks the climates of Europe and Australia. In England these cycles are marked by extremes of heat and cold, and in Australia by extremes of flood and drought. The hottest year of the century in England was 8 deg. warmer than the coldest. No such variation has ever been observed in Australia in the annual mean temperature of any place. On the other hand, the rainfall of England does not fluctuate year by year in anything like the extreme manner that it does in Australia, and yet the average difference between the hottest and coldest year in Australia scarcely reaches 2 deg.

The climate of Australia generally is affected by two great prevailing winds, the one being the great westerly wind that blows for 9 months in the year, from the Cape of Good Hope to Cape Horn, and which affects all the southern colonies; the other is the steady easterly wind, which is met with all up the east coast for the greater part of the year, and which is the more marked the further northward we go.

The westerly winds of the Queensland winter cannot, I think, be identical with the first one spoken of. They originate within a few hundred miles of the coast; doubtless attracted by

the superior winter temperature at the sea-side, and the almost certainty with which they follow after rain and thunderstorms, either in summer or in winter, would seem to favour this supposition.

There are few people who cannot in some way or degree assist in the furthering of this most interesting branch of physical science, although but a limited number can have the opportunities and ability to rival the researches of men like Maury and Glaisher, Humboldt and others. Every little, however, in this, helps to form the great whole, and I hope the time is near when Adelaide, Melbourne, Sydney, and Brisbane will daily exchange records of the wind, weather, &c., by telegram. They have had the opportunity for years, but never availed of it, so are as yet ignorant of its benefits. But, apart from this, we shall find the science interesting within the boundaries of our own colony. The climate of any country is the first subject of enquiry among persons wishing to know all about it, and in Queensland, where we invite and expect thousands of our countrymen to settle among us, we ought no longer to be scientifically ignorant of our climatic capabilities, agricultural, pastoral, and sanitary, so far as they can be ascertained by observation and record, and the use of a few instruments and at the outlay of a few hundreds annually. It is a provision of nature that every country can or does produce the food and medicines most suitable and requisite in its climate, and where these do not grow naturally they only require introducing, and here meteorology can save a multitude of useless experiments.

The climate of Brisbane has been compared with that of Madeira. The climate of Rockhampton and its vicinity appears to me to be comparable with that of Rio Janeiro; there are the same annual mean temperature, 74·5; the same rich soil and abundance of water everywhere; the same tangled scrubs. The sea-cow or dugong, the alligator, the gorgeous parrots, &c., are common to both places, and no doubt that which grows in and about Rio would also thrive in Rockhampton.

Other resemblances of climate will in time be brought to light in our new colony, and we shall be able to tell the world what we can do within our own borders.

I will now conclude this notice of meteorology with a list of the instruments required at each observing station, and the prices of each:—Standard barometer, £10; hygrometer, 30s; max. shade thermometer, 30s; min. ditto ditto, 30s; solar radiation thermometer, 30s; rain gauge, 30s; box of ozone papers, 20s; and anemometer.

The reading of the above communication gave rise to a lengthy and animated conversation, in which all the members present took part. A suggestion was thrown out by Mr. Rawnsley well worth the consideration of the Government, regarding the taking of observations. It was to this effect:—The telegraphic stations, which are, or are to be, would form excellent stations for making meteorological observations, and by arrangement, the station masters might do the double work. Even as matters at present stand we should then have observations made simultaneously at Cape Moreton, Brisbane, the high lands of the Downs, the Burnett Plains, Rockhampton, and Port Denison. It was thought by some members present that the society should take some action in the matter; but the opinion of those prevailed who thought it most probable that the Government might move in this important matter, and that therefore, they should wait a short time before taking any further steps. The Chairman vacated the chair at a few minutes after ten p.m.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

The usual monthly meeting of this society was held, on the 2nd of February, at the Municipal Chambers. His honour Chief Justice Cockle, president of this society in the chair.

Mr. Gordon Sandeman, M. L. A., was admitted a member of the society. Mr. F. R. Boyce was nominated for election, as a member by Mr. Diggles, and seconded by Mr. McDonnell. It was decided to hold a meeting of the Council, for the purpose of revising the rules of the society, after which a general meeting of the society will be held.

Mr. Le Gould then read for the meeting the following paper, which he illustrated by the exhibition of a large number of geological specimens, including copper ore, bituminous coal, &c., &c. :—

Geographical and Geological Observations in Northern Queensland.

About the end of November, 1862, I left Brisbane for the purpose of proceeding to the Peak Downs, North-western Queensland, under instructions to make a survey of mineral lands said to exist there.

It is unnecessary here to dilate on circumstances consequent upon a short sea passage; suffice it to say that I arrived in Rockhampton, and proceeded in due course, with party, horses, stores, &c., in good order.

It was not my first visit to the north; but every time I have been struck with the great difference which exists between that country, geographically, and the country around Brisbane. The country about the southern banks of the lower Fitzroy is generally very flat and fertile, with several very fine lagoons interspersed here and there, which seem to be fed chiefly by the back water and overflowing of the river; some of them, indeed, are more like small lakes; and in which aligators abound. I have seen, personally, on one occasion, two of these animals, which, judging from observations at a distance, I should estimate were between twenty and thirty feet in length.

In passing through Yaamba, a village, still on the Fitzroy, but on the north side, and where the river is fordable, the same character of country meets the eye; everywhere the same flat unbroken country, lightly timbered, and apparently fertile, yet but for an occasional glimpse of the stream, would be extremely monotonous to the view.

By the way, I saw a vast number of aboriginal natives, who had long since taken up their permanent abode in the very heart of the village of Yaamba. Natives of all ages. From the old, gray, time-honoured patriarch, to the youngest picanniny, nearly all naked, living in the rudest and most primitive manner, whose great business of life seemed to be lounging, begging, and obtaining grog from travellers; too lazy to work, and too indolent to forage out their own food, but trust to Providence and the generosity of the white settlers.

Beyond Canoona the geographical features rapidly change: they become stoney and broken, and preclude the eye from penetrating any material distance, except to the surrounding ranges. Canoona is known for its gold celebrity; it was this district to which the

great disastrous "rush" for gold took place in 1858, when many thousands narrowly escaped death from starvation.

The site of the gold-field is situated about nine miles north-east of Canoona station, in an alluvial flat. This place bears very strong indications of being auriferous; near at hand there are some moderately high ranges, with numerous broken gullies. The surface of this range is strewed with debris of quartz—and I traced reefs traversing the range parallel with the line of cleaveage in the slate. The slate rock dips north-easterly, rather finely laminated, and is very friable.

The geological features and rocks about Princhester evidently belong to the stratified class, and extensive indications point to the presence of "mountain limestone," thick bedded grayish stones, and shales.

I found this rock crossing or flanking some trap hills which are in the neighbourhood, and immense boulders lie about in places, and occasionally piled one over another as if in the antediluvian age they had been placed there by the hands of giants. Here and there it is traversed by beautiful veins of calcareous spar; it has a variety of colours, but is mostly grey, and varying in intensity of shade.

I found it also associated with calcareous sandstone rock and shales; abounding in organic remains, and portions of the coral, and the encrinite were found which point to a marine origin.

After crossing the first branch of the river Mackenzie - the Isaacs, a beautiful stream—I came upon a great belt of dense mixed scrub, which extended to the other branch of the river, a distance of something over twelve miles, and so dense was this scrub in parts, that a passage through it was a physical impossibility; however, the squatters beyond had succeeded in cutting an imperfect narrow track through it, for the convenience of bringing down their bullock teams of wool; but a passage along this track, with a drove of horses or cattle, must be no easy task.

The trees and plants in this scrub are of immense variety, so great, indeed, that a botanist would find himself bewildered at its extent.

In some parts the scenery is charming in the extreme—one could almost imagine himself to be among the delightful shrubberies of fairy-land, with here and there a sandal-wood tree shedding its luxurious perfume around; indeed, they very much resemble—the absence of flowers excepted—some of the most beautiful shrubberies I ever saw, even to the light gravel walks among them.

I was struck with the extraordinary character of one species of large tree, which bore in great profusion a kind of bean, somewhat like the French bean in shape, but larger, being about ten inches long and a full inch broad. On examination, I found the inside to resemble the broad bean, containing about seven large oval beans, with the interstices filled up between them with solid vegetable matter. Having been without vegetables for many days, I felt very much tempted to cook and eat some of these beans, but caution restrained me, not knowing their nature, and being beyond the reach of medical aid in case of accident.

Two days more brought me within sight of one of the most magnificent and imposing scenes to be found in the interior, one that is calculated to inspire with awe the beholder when it first meets his view. A gigantic eminence of granite or basaltic rock, rising almost perpendicular from the earth, from a base of about 20 chains in breadth, to a height of about four or five hundred feet. The face of this immense rock was denuded and craggy; its slopes on either side nearly equal in form and are covered with trees and verdure. It seemed to be an abrupt end or section of a range, as a range extended from it for miles beyond, and it gave the impression that this range had been suddenly broken, through the medium of volcanic agency; and, indeed, something of this might have been the case, as there appeared the continuation of a range some mile or two from it in the same bearing.

The denuded rock had a variety of shades but mostly of a dark green, or grayish colour, and the magnificence of the effect, when the sun fell on it with his rays, was truly grand.

At the bottom, the ground is extremely broken, and tremendous boulders, many tons in weight, lie scattered all about. There is a deep creek running through the valley, which is also very rocky and broken, and the verdure is chiefly large fern, with some good sized trees growing about.

While I was yet in this valley, I came upon a very large gum-tree, divested of all bark, leaf, and even life, that lay across my track. It had been sharply broken about 5 or 6 feet from the ground, through its base, which was three to four feet in diameter. I wondered what could have broken so huge a tree in so sharp a manner, as it had not the appearance of having been struck by lightning. I dismounted to examine it, and found a great bruise or indentation in the trunk on the ground.

I proceeded to examine the locality; and about fifty or sixty yards away, saw something which appeared like a large cannon-ball. My surprise was great, believing that no artillery of such a calibre had ever been so far inland. On inspection, it proved to be an aërolite. It was of a dark metalic colour, extremely hard, and about 10 inches in diameter; in fact it very closely resembled a 10-inch shot, and was about the same weight. It was perfectly round, except that one side was slightly flattened; its surface was extremely smooth, and very slightly perforated. The extraordinary appearance of the tree was now clearly accounted for in my mind;—it

must have been struck by the aërolite on its downward passage to the earth, which evidently caused its fall.

I regret that my limited means of transit did not permit me to bring this extraordinary phenomenon to Brisbane for this society; but my next visit may enable me to do so, as I have planted it for that purpose.

Two or three days afterwards I camped in a forest of sandal-wood, and made my tent poles and fires with this timber; for miles round there is scarcely any other kind of wood, which when burnt, emits a very pleasant odour.

It is of little practical value, I think, as the trees do not attain any great size, 10 inches in diameter being about the maximum, and the wood, when seasoned and worked up, soon loses its perfume, as this specimen will show.

The following day I came upon a complete petrified forest, which I found, by the time I got through it, to be nearly 60 miles in extent.

I may premise however, that I camped two or three times in this forest, and, as I halted early in the day, I occupied the remainder in general observation of locality; and it is from this place that I brought many of my geological specimens.

The geological features about here are of the secondary formation, and allied to the carboniferous system. This system is very extensive, not only comprehending the coal measures proper, from which its name is derived, and which consists of alternating strata of coal, sandstones, shales, &c., but also embracing the mountain limestone, which is found to underlie the coal groups, and which, in turn, comprehends alternations of limestones, shales, and imperfect beds of coal.

The coal rock is a mass entirely of vegetable matter, which has accumulated in certain places, and afterwards been covered over, subjected to heavy pressure, and by bituminous fermentations has been converted into coal of several varieties.

There have been two hypotheses advanced respecting the manner in which coal was formed; but as so many geologists have written on the subject, I will refrain from going into detail.

I may here mention that, while camped one day in the forest, I discovered a very fine seam of coal of immense extent, of which this is a specimen.

The surface of the forest is entirely covered with "fossils of the carboniferous group," of which many of these are specimens; they vary in size, but these are among the smallest. There have been more than 300 species of plants discovered in this group of rocks, all of which are now extinct. Some of them are ferns and reeds, while others consist of large trees.

I have traced whole trees 50 or 60 feet in length through this forest, with their limbs and branches perfectly visible, and their trunks varying from 12 to 20 inches in diameter, embedded in the shale and sandstone formation peculiar to this system, but all petrified. As usual with fossil substances, they are converted into the material in which they are embedded, but preserve all their original lineaments, except that many of them are somewhat flattened, being the result of the pressure which they have sustained.

I also noticed several large fossils, stumps of trees, in their original vertical position, from 2 to 3 feet high, and about 12 inches in diameter, the roots being embedded in the shale beneath.

The living trees of this part are chiefly bricklow, myall, sandal-wood, ironbark, and a variety of other hard woods.

Emerging from this forest, the fine open plains of the Peak Downs completely change the aspect of travel. Here and there is a narrow belt of scrub, known as the bottle-tree scrub, with huge trees growing in them, resembling a lemonade bottle in form, some of which measure as much as 25 feet in circumference at their greatest diameter, and vary from 20 to 30 feet high.

In conclusion, I will briefly notice that gold was first discovered about thirty miles to the eastward of the Drummond Ranges, in a sandy creek. The workings of the gold-fields are gradually moving westward towards the range, where I am persuaded the centre of deposit will eventually be found.

The gold is of a rich bright colour, much resembling that worked from the fields of Ballaarat.

With reference to the copper which is in this locality, Mr. William Keene, the eminent geologist of New South Wales, who has recently visited the mines, says the mineral bed, containing malachite, blue carbonate, gray copper, and hæmatite and magnetic iron ores, extends in the direction of, from the appearance of the out-crops, nearly east and west.

That after attentive examination he had come to the conclusion that these minerals do not exist here in the nature of lodes, or veins and cross-courses, but as a regular bed, occurring and deposited conformably within a wide series or succession of sedimentary clay, and quartzite chlorite shales; and this bed belongs as much to the sedimentary series as the shales themselves, and does not belong to any system of lodes or veins, enclosed by walls in mere fissures or ruptures of the containing rocks.

For this reason the metalliferous deposit is more regularly continuous than when in lodes, and can be traced by the out-crop at divers distances through the reefs.

He also satisfied himself by examination of the shafts put down, that the metalic bed of iron and copper ore was reached; and in the main shaft he found this bed, by measurement, to be 17 feet in thickness, composed of minerals varying from rich gray ore and fibrous malachite, both soft and indurated, to blue

carbonate, and the enclosing gossan and shales impregnated more or less with various per centages of copper.

The inclination of both the shale and mineral beds is of remarkable uniformity over a considerable breadth, showing an average angle dipping south of 30 degrees; and other observations afford presumption for the regularity of the deposit throughout, and that the mineral may follow the general rule of richness in copper, increasing with the depth.

These remarks I can fully bear out from my own observations while there.

Gold is also obtained in the drift of the gullies which run parallel to, and on both sides of, the mineral bed; and there can be no doubt that the successful working of these mines, (both gold and copper), will materially increase the ultimate wealth of northern Queensland.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

THE above society held its monthly meeting, in the Municipal Council Chambers, on the evening of Monday, the 25th of April last. Therewas a large attendance of members, and C. Coxen, Esq., M.L.A., vice-president of the society, occupied the chair. Chief Justice Cockle, president of the society, arrived after a portion of the business had been attended to. The minutes of the previous meeting was read by Rev. J. Bliss, secretary, and confirmed. Two new members, Messrs. J. M'Connell and Boyce, were introduced; and Mr. R. Austin was ballotted for as a member, and unanimously elected. The secretary handed a copy of the amended rules to all the members present. A vote of thanks was passed to the Entomological Society, of Sydney, for a copy of their transactions. The secretary asked instructions relative to the correspondence he had been requested to open with certain societies. It was thought upon the whole most desirable that the request should be made to certain long established societies, for copies of their printed transactions, without offering copies of the papers read before this society in return. Mr. Boyce volunteered to open a correspondence with some of his friends in Bombay connected with the Bombay Literary Society, a branch of the Royal Asiatic Society, with the special view of obtaining information regarding the cultivation of sugar and cotton. Mr. LeGould's motion regarding the press lapsed, owing to that gentleman not making his appearance till near the close of the meeting. The business of the meeting being disposed of, the Chairman called on Mr. BOYCE to read the following paper

ON CORAL ISLANDS.

THE subject I have chosen for my initiatory contribution to the society of which I have now the honour of being a member is the formation of coral islands. Without any pretension of treating the subject scientifically, I shall principally confine myself to personal observations. During my servitude in India I was attached to the surveying ship Benares, commanded by Captain Moresby, of the Indian navy, an officer to whom the world is greatly indebted for his surveys of the Red Sea, and also of the coral islands running parallel with the western coast of Hindostan, known as the Laccadive and Maldive Islands, and extending to the Chagos Archipelago. This talented officer, since dead, was a brother to Admiral Fairfax Moresby, of the Royal Navy, in which service the gallant admiral distinguished himself as an accomplished surveyor.

Before proceeding further I would remark upon the amount of admiration which is apparently bestowed upon works of art. How much is thought of those useless piles of stone, the Pyramids of Egypt! what praise is lavished on the architectural beauty of some buildings and the magnificence of others! what admiration on the engineering skill and ingenuity displayed in our modern bridges and railway works; but all these sink into insignificance when brought into comparison with the magnificent and stupendous works which have been for ages past, and are likely as long as the world lasts, to be carried on by those diminutive creatures, known as zoophytes. Through the agency of these

comparatively small creatures, the Almighty in his infinite wisdom, has effected the most extraordinary changes on the face of the globe, over spots where ships in ages past have doubtless crossed, there are now beautiful islands, covered with verdure and tall trees, and teeming with human life, nor is this confined to narrow limits; thousands, I might say millions, of these formations are to be found in narrow portions of the globe—all the result of the operations of the zoophyte.

I find on reference to authorities on the subject of zoophytes, that it is to the genus helianthoida that we are to attribute those vast coral formations, which, as I have already remarked, are to be found in almost every maritime portion of the world. It is now well ascertained that these formations are caused by an excretion of calcareous matter from the inferior portion of the body of the zoophyte—a quantity of calcareous matter, the deposition of which, under and around the body, and in the tissue of the folds formed by the tunics of the abdominal cavity, constitutes the cell or polypidom into whose hollows the tenant can partially or wholly retire. The stony substances so formed are called corals, and their mode of formation causes them exactly to represent the animals which secrete them—the upper surface is always furnished with radiating plates, the remains of the calcareous particles which were deposited in the longitudinal folds of the stomach before referred to; and as these plates do not usually reach to the centre, there is almost always a vacant space in the middle between them. The cells are either single or cupped, or they are branched like a tree, or they are aggregated together so as to form a resemblance to a cauliflower, or even to imitate the human brains—all these variations resulting from the manner in which the animal emits from the whole surface, or from a particular part of the sides of the body, the bud by which the new individual of the general mass or society is produced. In the absence of any positive theory as to the process by which the zoophytes form the calcareous deposits alluded to, I would remark that having for some years been employed in long sea trips in steam ships, after a run from Bombay to Suez and back, in examining the boilers, we always found a hard calcareous deposit of three or four inches thick at the bottom of the boilers, and on inspection this substance bore a strong resemblance to madrepore. I infer, therefore, that the calcareous deposits made by the zoophytes may be caused by the action of some powerful acid, existing in their bodies, on the salts contained in sea-water. This idea never struck me when I was in a position to put it to the test; I merely advance it now by way of suggestion to those who may have an opportunity of enquiring into the matter. The helianthoida are all oviparous, the ova being produced in appropriate ovaries situated between the compartments formed by the septa that radiate from the outer parietes of the stomach to the skin. The ova are contractile and motive being carried about from the action of the cilia that clothe the surface. Under the microscope they prove of diversified form, many resembling flattened peas, some elongated or exhibiting irregular prominences, some almost spherical, and some which cannot be referred to any particular figure. After moving about for several days, during which their forms suffer some slight change, they insensibly relax in their motility, the cilia disappear, and having become stationary, each ovum rapidly runs through the stages of development, that lead it up to the similitude of its parent. The productiveness of the species and the rapidity of their growth are very great. The calcareous species often form enormous masses of coral, of the size of which we cannot judge by the specimens usually shown in collections, which are small individuals taken in the sheltered places among the rocks, where they are not exposed to the action of the waves, and collected before they have reached their proper magnitude. The form of the masses appears to be greatly influenced by the positions in which they have grown; and the size of the individual depends on the quantity of nourishment it is able to procure. This is proved by the fact that if all the individuals of the same mass are equally exposed, they are of an equal size; but if the surface of the coral is waved, the individuals on the convex part of the mass, which could procure the most food, are large, while those in the concave or sunken parts, are small.

The productions of the coral animal in the warmer parts of the ocean, are not only wonderful in themselves on occount of their vast extent and the minuteness of the animals by which they are created, but highly interesting for the light they throw on the history of the globe. On the north-east coast of Australia, that is to say, on our own coast, there is a reef 1000 miles long. The shores of the island of New Caledonia are fenced in by a reef 400 miles in length. The coral islands of the ropical Pacific Ocean are innumerable, and are well known to all by the glowing descriptions of voyagers. These productions may be referred to three classes—Atolls, Barrier Reefs, and Fringing Reefs. The first consist of a circular wall of coral, rising from a considerable depth, surrounding a lagoon or sheet of smooth water. The wall is seldom entire throughout, for there are places through which the water can find its way from the ocean into the interior. The bottom of the confined water is usually cup-shaped, with a depth ranging from a few fathoms to fifty, whilst the outer side of the reef falls at an angle of about 45 to a depth of from 200 to 300 fathoms. In violent storms large pieces of the wall are broken off and driven into the in-

terior cavity, which thus becomes more or less filled up, and a low island is formed to which floating seeds are carried, that take root and flourish. A barrier reef only differs from an atoll in that it runs parallel with some large island or continent, from which it is separated by a broad, deep channel; the outer side sinks at a sharp angle into deep ocean. The fringing reefs have only a narrow and shallow channel, between them and the land where the water on their outer side has small depth. Now it appears that the coral animals cannot live at a greater depth than thirty fathoms, and if exposed to the direct rays of the sun, uncovered by water, it will perish. A consideration of these facts has led a learned naturalist to form a theory, which has generally been accepted by scientific men. He believes that the phenomena in question are connected with movements which simultaneously affect large portions of the earth's crust, such as that by which the coast of Sweden, to the extent of some hundreds of miles, is now being elevated. He thinks that atolls have their foundation on land, which has subsided and part of which was once above the level of the sea; that barrier reefs show that the land near which they are situated is likewise sinking, and that fringing reefs on the other hand, denote that the land is either rising, as in the majority of the Sandwich Islands, where old reefs have been elevated to a considerable distance above the sea, or that the land is stationary. An examination of the chalk and limestone beds of the earth's crust, shows that they are in great part composed of corals, all the species of which are extinct. Hence it may be conjectured, that the labours of existing zoophytes will remain to after ages in the shape of calcareous beds when the species themselves will have disappeared. The foregoing remarks have principally been gleaned from the best authorities available here. There is one portion of what I have just quoted, which is of great importance to us generally, and which demands the particular attention of this society. I allude to the theory that the existence of barrier reefs shows that land near which it is situated is sinking. If this hypothesis is correct, and as we are exactly in this position, so far as 1000 miles of our N.E. seaboard is concerned, it would be highly interesting to test it by actual observations, which might easily be made by residents at our Northern Ports, and although the process of subsidence may be very slow, still the coast-line would always show sufficient indications to confirm or confute such a theory as applicable to our own particular case. Having, as I consider, stated all that is necessary for the introduction of my subject, so far at least as regards its scientific bearings, I will now proceed to state my own impressions and experiences during nearly three years, a greater portion of which was spent amongst the Maldive Islands and Chagos Archipelago. My object is not to enter into a description of these islands, so much as to endeavour to convey my own general impressions regarding them as merely coral formations. On approaching these islands a slight indistinct fringe is observed on the horizon, which, as the vessel gradually draws nearer, assumes a denser appearance, and soon the tall graceful cocoanut palms, the gigantic banyan (ficus indicus), the bread fruit tree, the banana, and a variety of other trees, plants, and bushes are developed, and a wreath of white foam is seen as the breakers of the ocean dash heavily against the barrier reef, and apparently threatening, in their fury, to wash away the fairy islands which seem to have suddenly risen out of the sea. As the ship draws near, the reef seems to be one unbroken line of breakers, and to one who for the first time approaches such a scene, it causes rather a nervous sensation, and the danger of being dashed to pieces seems imminent. Presently an interruption is observed in the line of breakers, and a channel is seen through a chasm of the reef, through which the ship glides into a beautiful smooth lagoon. The sudden transition from the rough chopping sea outside to the quiet lake-like water within the lagoon, is something delightful. It is true that the heavy dull sound of the sea, as it breaks on the barrier reef, is still heard, but it only tends to realise the security which one feels in being snug at anchor in smooth water. The water within the lagoon is of an emerald green color, whilst that which has been left outside is of the deepest blue. Let us fancy the ship securely anchored in the centre of an atoll of about seven miles in diameter; the barrier reef we will suppose to be about a quarter of a mile broad from its outer to its inner circle. Let us imagine it to be low water, and the whole reef exposed to view. On a portion of the inner circle of reef is a low sandy beach, above which a bank, seldom more than six feet higher than high water mark, the rise and fall of the tide being, say, four feet, is covered with an undergrowth of low shrubs, above which the cocoanut palms and other trees rise. This bank may extend outwards to one-fourth or more of the barrier reef, and forms a habitable island, upon which the natives build their habitations.

At high water the barrier reef is covered, but not to any depth, by the sea, the fury of which is overcome upon the outer barrier, otherwise the low island just described would soon be washed away. We have already imagined that it is low water. Let us further accede that the weather is calm, and the sea outside perfectly smooth. We take advantage of these favourable circumstances to take a stroll to examine the barrier reef, which is composed of various descriptions of corals and dead shells. Our progress is slow, owing to the unevenness of the ground, and the necessity for avoiding deep fissures and channels which have not yet been

filled in by the zoophytes. In these our little artizans are busily at work ; and these portions of the reef contrast greatly with those main portions on which the zoophytes have made their operations, where all is decay. Arrived at the verge of the outer reef, we are induced to lie flat on it, and with our head projecting over it we gaze down first with awe and astonishment into the abyss below us ; and nothing can exceed the grandeur of the scene which presents itself. The water is perfectly clear and transparent, and for several fathoms below the observer is a succession of masses of beautiful corals, sea plants, and weeds of every variety of hue, rising out of a white sandy bottom, which shelves more or less abruptly towards the ocean, or, not unfrequently, inclines inwardly towards the reef like a mushroom, giving one a feeling of insecurity when he reflects that it is just possible that the ledge on which he is reclining might give way and carry him into the depths below. I have frequently, when I have seen beautiful and rare shells glittering amongst the white sand apparently only a few feet below me, thought of taking a dive after them, but the idea of a shark lurking in some concealed crevice under me, would give a most decided negative to so rash a proceeding. An examination of the reefs, although attended with much labour and fatigue, amply repays one for the wonders they develop; the naturalist may generally return from such an excursion laden with treasures. I usually carried a chain-hook, such as sailors use for handling a chain cable: with this I was enabled to turn over large fragments of coral which had been detached from the outer reef and driven into cavities, around the base of which beds of white sand, or, rather, pulverised coral, had accumulated ; in these beds, or adhering to the lower portion of the coral thus turned over, I have collected many beautiful specimens of cones, corals, and other shells, a description of which would only serve to lengthen this paper. I cannot, however, refrain from remarking upon one species, which, from its size, forms no insignificant ingredient in the construction of the coral islands. I allude to the tridacne, or giant clamp shell. Some of these grow to enormous dimensions, and are usually seen with their valves open frequently a yard in diameter, and woe to the unlucky wight who introduces his hands, or puts his foot into this novel trap, the result of which would, inevitably, be loss of limb—such is the muscular power possessed by these gigantic oysters, for such they may be considered, their flesh being edible. These clamp-shells are often found entirely embedded in coral—the zoophytes slowly but surely work around them, and eventually build them into the general mass. We will now suppose ourselves back to the corner edge of the reef, where the bank, as already stated, slopes towards the lagoon. Here we find the coral teeming with life, and our little friends the zoophytes actively engaged in filling in the lagoon.

The appearance of these reefs when the sun shines on them is really beautiful, their colour vieing with the richest emerald. The reef being once raised to a level with the sea, we can easily imagine the action of the waves causing detached portions of the outer reef to accumulate, and afford, in the first instance, a shelter for sea-birds, which form their nests; and the matter deposited from the egg-shells after hatching their young, the remains of the fish with which they feed them, combined with their guano, soon renders the calcareous soil capable of supporting various kinds of vegetation, the seeds of which are carried by currents from the adjoining coasts or islands, and deposited on the new formation. This process is assisted by visits from migratory birds, which again deposit a variety of seeds with their dung—particularly those of fruit. A succession of vegetation which flourishes and decays, not only increases the depth of the soil, but rapidly affords means of subsistence to a variety of trees.

Finding that this paper has already exceeded what may be considered a reasonable limit, and fearing longer to trespass upon your time, I would suggest that if the members of this society feel interested in the subject, I might be permitted at some future time to offer some further information relative to that vast line of coral formations extending along part of the western coast of India, and southward of the equinoctial. I would now submit a rough diagram having reference to the formation of an atoll, and which I think will convey a clearer idea of the existing theory as regards the formation of coral islands than could possibly be given by any written description of mine.

A free and interesting conversation followed, on the subject of the paper, so far as it referred to the east coast of Australia, in which Messrs. Rawnsley, Wight, Diggles, and others took part, the two former maintaining that the coast was gradually rising, which fact seemed rather to militate against a portion of Mr. C. Darwin's theory of coral formations.

Mr. Coxen will read a paper on the Regent Bird at next meeting.

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QUEENSLAND

PHILOSOPHICAL SOCIETY

(From the *Queensland Guardian*, May 24, 1864.)

The ordinary monthly meeting of the above society was held on May 23rd, in St. John's School-room, Chief Justice Cockle in the chair There was very little business. The minutes were read and confirmed. Mr. Austin was introduced as a new member. A printed meteorological paper was placed on the table, the same which was published in the *Guardian* a few days before. The following curious and interesting paper was then read by Mr. C. Coxen, on the

HABITS OF THE REGENT BIRD

As some very interesting circumstances connected with the habits of this elegant and beautiful bird have lately came to my knowledge, and believing them to be hitherto unknown, I have considered them of sufficient interest to form a subject for the paper of this evening. The regent bird has been considered strictly arboral in its habits, feeding on fruits and berries; but, having had an opportunity of seeing it in captivity, and otherwise studying its habits, I have been led to a different conclusion. But I can well understand that the dense foliage of the scrubs (its usual *habitat*), together with its shy demeanour, have caused much obscurity as to its general economy; and, although this bird has been known to ornithologists for many years, very little of its habits has become known, and it has been left for me to bring under your notice the very peculiar and curious habit it enjoys in common with the satin bird (*ptilonorhynchus holosericeus*), and the pink-headed bower bird (*chlamydera maculata*). In corroboration of which, I call your attention to the extraordinary structure brought for your inspection this evening. My attention was called to this peculiarity in August last, by Mr. Waller, taxidermist, of Edward-street, in this city, to whose untiring energy and ability as a collector, I must always bear testimony, and to whom I most willingly concede the right of discovering the unique specimen now before you. Mr. W. informed me that, while shooting in a scrub on the banks of the Brisbane River, he saw a male regent bird playing on the ground, jumping up and down, puffing out its feathers, and rolling about in a very odd manner, which occasioned much surp ise, never having seen the bird on the ground before. The spot where the bird was playing, was thickly covered with small shrubs, but not wishing to lose the opportunity of procuring a specimen he fired at the bird but only succeeded in wounding him, and in searching the spot where he had perceived the antics of the bird, he found the bower now under inspection. To use his own words, he was never more surprised in his life, at the same time gratified at finding an object so interesting and new to the ornithological world. The bower was formed between and supported by two small brush plants exactly as you now see it (only that the plants have been denunded of their tops), and surrounded by small shrubs, so much so, that he had to creep on his hands and knees to get to it, and while doing so the female bird came down from a lofty tree with her peculiar note, and lit on a branch immediately over the bower, apparently with the intent of alighting in front of it; but was scared away on seeing Mr. W. so close to her. She continued flitting over the place and calling for her mate so long as Mr. Waller was in the neighbourhood. Mr. W. believes that the male bird, after being wounded, fluttered to some distance from the bower and died at once,

as a male regent bird was found dead two days afterwards in a more open part of the brush. On visiting the scrub on the following and several successive days, the female bird was seen in the locality of the bower, and by her constant calling was apparently lamenting the loss or what might seem to her the inconstancy of her mate. The ground around the bower was clear of leaves some 12 or 18 inches, and had the appearance of having been swept, the only objects in its immediate vicinity being the small specimen of helix to which I call your particular attention. The structure as you will perceive, is alike at both ends, but the part designated as the front was more easy of approach, and had the principal decorations; the approach to the back being more closed by scrub. Mr. Waller being desirous that this curious habit of the regent bird should be verified, he determined on leaving the bower untouched until he had acquainted me with his discovery. Circumstances occurred to prevent me from accompanying him to its whereabouts until the following November, when we found the bower in good preservation, and as had been described previously to me. Previous to my seeing and examining the structure, I must confess to having had considerable doubts as to whether it would not prove a bower of the satin bird, but these doubts were at once dissipated at the first glance, as the formation of the structure differs considerably, and the decoration (which I consider typical) more so. With Mr. W.'s assistance I removed the building without injuring or in any way defacing its architectural style. It may not be inopportune for me to state that I was the first to discover the bower and habits of the satin bird, and, also, among the first discoverers of the bower of the pink-headed bower bird, and that I have had frequent opportunities of seeing them in the New South Wales bushes and the myall scrubs to the westward, and am consequently conversant with their peculiarities. The bower before you differs from the satin bird's in being less dome-shaped, straighter in the sides, platform much smaller, being only ten inches by ten, but thicker in proportion to its area, twigs smaller and not so arched, and the inside of the bower smaller. Indeed I believe too small to admit an adult satin bird without injury to its architecture. The decorations of the bower, as you will perceive, are uniform, consisting only of a small species of helix, herein forming a marked distinction from the satin bird. The decorations of his recreation ground are of the most varied character, and consist of bright feathers, colored rags, and any other gaily colored articles, to be found in its locality; he also shows a marked appreciation for broken crockery. The bower of the *chlamydera maculata* differs from the last, both in structure and material; but what I wish more particularly to call your attention to is its peculiar style of ornamentation. The bower is formed of grass stems bent, and interwoven, as shown in the drawing now on the table; and, instead of selecting the gay-coloured objects chosen by the satin bird, its choice is confined to the whitest objects attainable, such as white pebbles, single valves of the *unio* so common in our rivers, and small bones, either bleached by exposure to the sun, or collected from the camp-fires of the aborigines. I have had very many opportunities of seeing the bowers of the last two named birds, and have ever found the decorations to be of as distinct a character as herein stated; and I am consequently led to believe that the choice and taste displayed by each species in the selection of decorative objects may be taken as a type of the domestic economy of each bird, and I am further borne out in this belief by referring to Captain Stokes' work on the north-west coast of Australia. In that work he states that, he found a bower of the *chlamydera muchalis*, or large pink crested bower bird (a bird hitherto only found in the north-west), and that the bower was built of sticks stuck in the ground, and occupying an area of 2½ feet by 18 inches, and nearly 2 feet high. The decoration consisted of shells, bones, and seeds, herein differing from its smaller congener. The nest of the satin bird never having been found, it may, and indeed has been asked, is it not possible or probable that these bowers are used as places of incubation? To this I confidently answer no; for although the nest of the satin bird has not been discovered by any collector, the natives unhesitatingly state that the bird makes its nest in the high gum trees found in the scrub, and I myself, found a nest of the *chlamydera maculata* with young birds in it some years ago on Oaky Creek near the present Jondaryan head station, on the Darling Downs; the nest was built in one of the *myrtaceæ* overhanging a waterhole, near a scrub, on which a bower was built; and I am further borne out in this opinion by the absence of all *debris* and other matter so consequent in all spots chosen for the purpose of nidification. I am, therefore, disposed to believe with Gould that the bowers are only used at the advent of the breeding season, and then as a rendezvous or courting ground during that interesting period. The regent bird frequents our river scrubs during the winter months, from the beginning of May to the end of September, coming from the south whither he repairs during the summer. Its food consists of berries, wild fruits, and insects. In confinement it greedily disposes of house-flies, cockroaches, and small insects, showing great activity in their capture, but its principal food is the banana, of which it eats largely. It is very bold and pugnacious—the young males most particularly so. In confinement several cases have occurred of one

having killed the other. The young males closely resemble the females in plumage during their first year, in the second they partially assume the gay plumage of their sire, and in their third year they pu on the full livery of the adult male.

Mr. Coxen exhibited a case containing the male and female regent bird, snd also the bower constructed by them; which formed the subject of this paper.

After the reading of the paper, a free and interesting conversation ensued amongst the members present, as to the general habits of bower birds known to exist. Mr. Rawnsley quite coincided with Mr. Coxen, that the specimen on the table was perfectly new to science, and stated, that when shooting on the Illawarra brushes, and other scrubs in New South Wales, he had frequently seen the bower of the satin bird, and had observed them when building their bower; and that he had observed the male birds—they being the workers—steal feathers, and other ornamental objects, from the bower of their neighbour to decorate their own.

It was also pointed out, that Mr. Gould had shown his usual power of observation and knowledge of generic distinctions, in having placed the regent bird next in order to the satin bower bird, without, on his part, having the most remote idea or knowledge of peculiar building instincts. Mr. Coxen was of opinion that there was another bird in our brushes that would eventually be found to enjoy similar habits—*Ptilonorynchus Smithii*, or cat bird. Its anatomical structure was generally the same as the satin bird; and the natural inference was, that it possessed habits in common with birds of its own genera. This inference, Mr. C. said, was in some measure borne out, as he had received information of a bird similar to that last named which built a peculiar kind of structure in the bushes some two or three feet from the grass; he had not seen it himself, but could not doubt the correctness of the information.

It was stated that the nests of the satin bird and cat bird were in high trees. Mr. Rawnsley, indeed, had obtained that of the last-named bird in a very high tree in a scrub. An extract was read from Gould's work, in which an account was given of a bower built by the satin bird when in captivity, thus proving beyond a doubt that these places were used only as a playing ground; and it had been observed that the male bird would endeavour to attract the attention of the female, and induce her to visit the bower by calling her by a peculiar note, and strutting round and through the opening; and would pick up a feather, play with it, and then either stick it on the side of the bower, or lay it before the entrance.

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QUEENSLAND

PHILOSOPHICAL SOCIETY

(From the *Queensland Guardian*, June 21, 1864.)

The above society held its ordinary monthly meeting in the temporary room of the Municipal Council, George-street. The President of the society, Chief Justice Cockle, not being present when the meeting commenced, Mr. Diggles, as senior member of the council, occupied the chair. The minutes of former meetings were read and confirmed. Alderman Pettigrew kindly offered the use of a room to the society, in which to hold its meetings till such time as other arrangements of a more permanent nature could be made. The offer was thankfully accepted. In the absence of Mr. Coxen, Vice-President of the Society, the Secretary—Rev. Mr. Bliss—requested Mr. Rawnsley to read the following practical and valuable paper, by Mr. Coxen, on

The Geology of Western Queensland.

"It has been remarked by most of our Queensland travellers that wherever basaltic rocks predominate the country is rich and valuable. This is particularly the case at Fitzroy Downs, and throughout our western territory. But beyond this point of similarity with Darling Downs, and other localities not far removed from the east coast, I know of no well-known place which could be alluded to as giving an idea of the country in the interior, as, from its geological formation, it has a character of its own. For the pioneer settler—I mean the man who has to occupy the country for a few years, and make the most of it as he finds it—there may be said to be only two classes of country, viz., very good, and very bad. Fitzroy Downs, and a great extent of country to the west and north-west of them, consist of shales, chiefly blue marl. In the vicinity of basaltic mountains, the soil which covers the shale is to a great extent decomposed trap, mingled with a highly calcareous sand. This forms the basis of a very rich soil, of a lighter character than that which generally prevails on Darling Downs, and well adapted for either pastoral or agricultural purposes. The most easterly point at which I have observed the shales is at Dulacca; or from the appearance of the country, they possibly extend as far east as Wallan head station. Thence they trend westward along the base of the Main Range, and attain a considerable width from north to south at Wollombilla. The formation then underlies the whole extent of Fitzroy Downs, crosses the Maranoa River, and occupies a considerable portion of its valley, as far north as Possession Creek. West of Mount Lonsdale, there is a high sandstone range, which divides the waters of the Maranoa and Ballonne from those of the Warego. West of this range the shales again appear on the Warego, River Ward, and other tributaries of the former river. West of the Grafton Range, on the upper waters of Bungil Creek and the Amby, there is a vast field of calcareous sandstone, which stretches north, occupying much of the eastern portion of the valley of the Maranoa,

all that of the Merivale River, and then forms the high table land in which the most northern tributaries of the Darling take their rise. Above these great beds of calcareous sandstone, there is a layer of trap of great thickness in some localities, and of less in others. I have not, myself, been able to discover any evidence of volcanoes, but Sir T. L. Mitchell mentions several. A great portion of the Main Range appears to be formed by the basalt forcing its way through the crust of the earth by one or more great efforts, and overspreading the previously formed sandstones for many miles. Mount Owen, Mount Ogilby, and the other basaltic peaks which form so picturesque a feature in that locality, are not volcanoes, but the remains of a vast field of basalt of which the land has been denuded by powerful destructive forces. I think there can be no doubt of this, as the sandstone which underlies these peaks is undisturbed, which could not have been the case had volcanic action of that character taken place at those points. I may further mention, that from its relative position to the other formations, the basalt appears to be the youngest *solid* rock. With respect to the calcareous sandstones, there are several layers differing somewhat from each other, on the heads of the Warego; the upper layer is pebbly. At St. George's Pass, on the Amby, the lower and greater mass of rocks has been much disturbed, some parts of the strata being almost vertical. Above this there is a stratum about four feet thick, which contains small modules of quartz and water-worn trap, together with gaping shells such as belong to shallow waters. In the great lower beds of sandstone I have found no shells, but on the heads of Bungil Creek they contain coal and lignite. I may here mention, with reference to the coal, that our Queensland fields appear to be of great extent. I need not mention those known on the coast; but on Darling Downs this valuable mineral has been found on several of the stations. On the Condamine a seam crosses the river bed about two miles below the junction of Charley's Creek. Further west a seam again crosses the river four miles above Tierryboo head station. We again find it near Wallon, and on the Moonie river, also, as I have stated, on the heads of the Bungil; thence crossing the main range on some of the heads of the Dawson, on Mount Hutton run; near the sources of the Warego in the vicinity of Mount Owen, there is also coal, and when crossing from the Merivale to the Upper Maranoa—although I did not see the mineral itself I observed the usual indications of its existence. Thus should ever railways extend from Brisbane to Carpentaria we can, at least, make sure of coal—such as it may prove to be—for 400 miles of the route. I have only found one example of bituminous shale; the coal seam is about seven inches thick, it lies to the north of Mount Kennedy, at Appletree Creek. On the Comet river there is a coal seam of much older date than the calcareous sandstones—it is the equivalent of the Newcastle coal. On Fitzroy Downs I have found numerous specimens of sandstones which belong to the same system, but no longer exist *in situ*, or, at least, near the surface. The rocks which I have seen have been altered, and sometimes fused by extreme heat, probably at the time of the eruption of the basalt. They now constitute the greater portion of the gravel which is so plentiful on the surface of the Western Downs and are also found imbedded in tertiary rocks. From the evidence which has reached him, my esteemed friend, the Rev. W. B. Clarke, writes to me, "I cannot help thinking that the coalfields of Newcastle pass under your newer formations." I will take the liberty of calling the attention of the society to this important subject, not only as a scientific but as social question. It is quite possible that this valuable coal may crop out at various points as well as at the Comet river. We have no survey, and it is scarcely probable that one will be made for some years. But if your society can induce people who have coal on their stations to forward specimens, particularly of the flora, you might, from data already known, form a reasonable conjecture as to whether we have a really good steam coal at points available for our future railways. In addition to the calcareous sandstones, there appears to have been deposited at a later period, a pebbly sandstone grit, highly impregnated with carbonate of iron. That on the summit of Mount Red Cap is of this character; it is a tertiary rock. The rock, generally, has suffered much from destructive forces, and now exists chiefly in detached peaks or low ranges of limited extent. I have found no fossils in this rock, but it contains fragments of fossilized wood, the outer surface of which is almost metalized, whilst the core retains a singular fibrous texture. There is only one other rock to mention, namely, the conglomerate of clay, sand, and pebbles, which, together with psammite, occupies a great portion of the valley of the Condamine, and then trending westward south of the Fitzroy Downs, crosses the Maranoa south of Mount Colby, and, from the description of the country, I rather think extends beyond the Warego. I have seen it on the Warego waters. Wherever I have found this class of rocks the country is of a very poor character. The flats are, in many instances, tolerably good, owing to the amount of vegetable matter which the soil contains. But on the ridges the rocks crop out, and are everywhere near the surface, and there is but little soil. Timber is abundant, but of an inferior quality, being brittle and liable to early decay. Grass seed is prevalent, and ruinous to sheep; cattle, however, get very fat, and succeed well if they can be kept

from getting wild in the scrubs common to this class of country. I have made mention of altered rock, seen commonly in the form of gravel on the Downs of the west; some of these stones are highly quartzose, which is not the character of any of the sandstones. I have observed in sites south of Mount Colby, there are vast masses of water-worn boulders of great size of this altered rock. Tightly packed on the hill side, there are similar great bulwarks facing the south and southwest, on the base of the ranges which project from the main range into the valley of the Maranoa. There are also in the same valley vast piles of these boulders, some of which reach a hundred feet in height. In other localities near the mountains, their beds of rock are almost entirely composed of fragments of fossilized wood. On a tributary of the Maranoa (Basalt Creek), I found this formation in conjunction with shells. On Blythe's Creek, where there are similar rocks and the stem of a tree about fifty feet long, there are extensive beds of shells, such as inhabited shallow waters in the immediate vicinity. There is lso on the Amby a large mass of fossilized wood, to which three bivalve shells clung, just as the oysters now fasten themselves to the mangroves. These various indications, together with the great destruction of the rocks, have left me under the impression, that the country which I have endeavoured to describe, viz, round the base of the main range, was once a coast. With respect to the fossil shells, they are to be found over a great extent if country. The most easterly point from which I have ever obtained one is Wallan (a belamnite). At Wollombilla creek they become numerous; they are there found chiefly embedded in round calcareous boulders; these boulders also contain fish teeth, and numerous minute organisms which can only be seen with the aid of a microscope. Fifteen miles west of Wollombilla I obtained the shells which I forwarded to your society. At the base of Grafton Range there again appears boulders with shells, many of them on the surface, amongst the grass of the Downs. Besides the boulders, there are some ammonites of great size. On Bunjewargorai Creek belamnites and small shells are numerous I have also found several copiolites in this locality, one of them very large, consequently, we may anticipate finding the remains of reptiles at some future period. Shells may be obtained on many parts of the Fitzroy Downs, in the bed of the Maranoa River, and far beyond it. Belamnites are very common on the Ward River. And on the sources of the Belyando, which is an eastern water, ammonites have been seen. How much further the formation may extend, I have as yet no knowledge."

The reading of the above paper gave rise to an animated conversation, in which all the members took part. A general desire was expressed that members of the society, who were acquainted with the country, should communicate such information as they might possess, in papers similar to the one furnished by Mr. Coxen.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, September 21, 1864.)

The monthly meeting of the above society was held on September 19, in the house of Alderman Pettigrew. After the minutes of the previous meeting were read and confirmed, two new members, namely, Mr. James Warner, and Rev. James Love, were received unanimously by ballot. The Hon. Arthur Macalister, Messrs. T. B. Stephens, Byrne, and Sheridan, (Maryborough), were proposed as members. A communication was read from Charles Tiffin, Esq., accompanying several specimens from an iron furnace in New South Wales. A communication was also read from Mr. Grimaldi, Bowen, who forwarded a piece of alleged native bees' comb, with the cells perfectly cylindrical. Several members of the association gave it as their opinion that it was not the comb of the bee, but that of a very small wasp. The comb had not the waxy character, but the papery quality of the comb of the wasp. Thanks were voted to these gentlemen for their presents to the society.

The following valuable paper, which gave rise to a very animated and interesting conversation, was read by Mr. Diggles :—

Thoughts Suggested by the Theory of Mr. Darwin.

No one can refuse to Mr. Darwin the credit of having for many years devoted an immense amount of learning and skill to the development of his theory, especially as in connection therewith he has brought to light a great number of valuable facts and observations which are to be estimated quite as much as contributions to the science of natural history in general, as they are, according to his mode of thinking, confirmatory of his favorite theory. The book entitled "The Origin of Species by means of Natural Selection," is one which has had a large circulation, and been the means of making many converts to its doctrine, including some names of the highest standing and acquirements ; and it would ill become me, or anyone else, to approach this subject without the greatest respect for so painstaking and learned an author, though differing with him in many of the conclusions at which he has arrived. It might be argued that the view held by Mr. Darwin has a tendency to lead men to materialism, or to acknowledge nature as the author of everything ; and I think not without good reason, though the author himself disclaims such an idea. It is not for me to dogmatise and say his opinion or theory is true or not true. If true, its tendency must be to good, and it will prevail over other theories ; if untrue, it will only last for a time and disappear, as truth progresses. But it does not seem reasonable in the judgment of many, that the Divine Being should have brought into existence some millions of years ago, four or five types of animals, and the same number of vegetables, each form endowed with a marvellous capacity for improvement, and then have left them to take their chance. It may be said this is stating the matter too broadly, but the whole theory condensed into few words appears to amount to this. What should be the objection so often urged by Mr. D. against direct Divine interference ? Is not preservation only a perpetual form of creation ? Even as much as bringing into being of the innumerable races both animal and vegetable, which cover the earth. We are told by one greater than a philosopher that not a sparrow falls unnoticed,

and I cannot see the fitness of ignoring the element of a sincere and trusting religious principle in the examination or contemplation of any subject worthy of man's attention, and especially such as the present, in which wonder on wonder—mystery on mystery—meet us at every turn. The science of natural history is second to none in the interest to be found in its study; and so extensive has been the accumulation of facts in connection with this science, that few choose to embrace the subject as a whole, but are contented with a particular branch, devoting thier attention to some order, family, or genus; and, in thus restricting themselves, find abundant occupation for a lifetime. The division of labour thus tends to render the science of natural history much more perfect than it could possibly have become otherwise. And it will be proper to see whether those who have devoted themselves exclusively to particular branches of the science are of opinion that any countenance can be given to Mr. Darwin's theory. I believe, on inquiry, it will be found that only to a small extent any will be yielded, and only in such cases where naturalists have fallen into the error of calling varieties species. Some might go a step further, and allow that even some closely allied forms may have sprung from a common source; but, with the reservation that the breeds will intermingle and the progeny be fertile among themselves, Mr. Darwin does not, in any case, show a cause or reason why one species descended (as he supposes) from another should not intermingle. Hybrids among animals are not uncommon, even in nature; but by the beautiful law of order, implanted by the Divine Being when he first called them into existence, these disorderly forms are not suffered to continue. Thus, there is no confusion in nature; but every species is singularly well-defined, and keeps to its own. There can be no doubt that much truth is to be found in the affirmation, that there is constantly going on a battle for life between races; but, that in the struggle, only the best, stoutest, and most enduring are the forms preserved, is an assumption quite gratuitous, as I do not see why some of the weaker, who, from their very timidity, would be the most likely to retire out of danger, might not be preserved as well as the most robust—as, in a case of shipwreck, where even women and children not unfrequently escape, when the stout-hearted mariner falls a victim. There is no calling in question the fact, that of the innumerable forms of animal and vegetable life, very few, comparatively, arrive at maturily. The balance of forces is so exquisitely poised, that every species is kept within due bounds; and, there is a period, when circumstances caused by change of climate or unusual interferences of other kinds (but under the control of Infinite Wisdom), shall suffice to bring to an end species of both animals and vegetables in different parts of the world. Instance the Dodo of the Mauritius, the Parrot of Philip Island; and, as a day not far distant will probably record, the aboriginal of Australia. There is no doubt, that those species which are most numerous are likely to endure the longest, yet this will not always hold good, as geology informs us of families which were once very numerous, as the Ammonites, which have no living representative. The accidental introduction of a new plant or animal, or the creation of either in any given locality, would result in a struggle, supposing that spot already occupied; but if such were intended to have its location there, the other inhabitants must make room even at the peril of extinction. That a battle thus begun should end in the development of new species, because the stronger outlived the weaker I fail to see, though by this means an idea can be formed of the manner in which many creatures have become extinct. The manner in which every living thing is fitted to its place in the great machine of nature is beautiful to contemplate. The wisdom of the greatest earthly intellect would shrink from an attempt to improve or to modify any of the creator's works, and in studying the life history of any one being, whether bird, beast, reptile, or insect, would say that it suits exactly the sphere for which it was designed. What is natural selection? Certainly, if we exclude the idea of an overruling omniscient agent, it is a term without any meaning. If by it is meant the means employed by the great Creator to develope his mighty plans, to show to a wondering universe that every one typical form is capable of infinite change and modification, and also what is best suited to the kind of life for which the creature is destined, I can understand the meaning of the term. This is such a selection which has been employed during past ages, and is employed still. The most powerful argument used by Mr. Darwin in favour of his views is drawn from the fact, which no one will deny, that the various breeds of domesticated animals very often show more decided differences in form and color than do closely allied species of wild animals; and he broadly asserts that should any one, not acquainted with the wonderful fact that a systematic principle in breeding has brought about these results, be consulted respecting them, he would without hesitation pronounce them not only distinct as to species, but even in some cases as to genus. He argues at great length respecting the different breeds of domestic pigeons, and shows from the remarkable contrast in form, color, and habit, among these birds, that the interference of man during a long series of years has been the means of developing the great variety of forms, such as fantails, tumblers, pouters, &c. The different breeds of dogs is an equally wonderful feature; and certainly a naturalist from the planet Jupiter

would be very liable to form erroneous opinions respecting them, and would hardly be found to classify the Newfoundland dog with the Italian greyhound, or the turnspit with the bulldog. The same remarks apply to the breeds of horses, in which the racer could hardly be supposed to be of the same species as the heavy dray horse or the Shetland pony. Cattle and sheep, and other domestic animals, are subject to the same observations; but I shall not enlarge on this part of the subject, as we are all acquainted with most of the particulars on this head. Now the question is, what countenance does this remarkable fact (which we must all acknowledge) give to Mr. Darwin's theory? Because the intelligence of man has been directed by isolating individuals, having slight and unimportant deviations from their progenitors, coupling them, and repeating this process through numberless generations, therefore he supposes that nature has acted n a similar manner, though much more slowly. i(He supposes 10,000 years to be required to bring about such a deviation from a particular type as to constitute a new species.) To say the least, this is only supposition; and the proof wanting is that which Mr. Darwin is, as he admits, unable to supply. Naturalists argue that in the process of time thus occupied in transmuting a species, we should surely meet with intermediate forms, and assert that a graduated series should present themselves, bearing more and more marks of deviation from the supposed form from which they have been derived. Of course, there is no chance at coming to any such conclusion with respect to animals now living; but the testimony of the rocks ought to supply sufficient in those forms which are least liable to decay, as in the testacea. Thus, we might expect to find in the last beds of lias and oolite, which must have taken tens of thousands of years to be deposited, typical forms belonging to the lowest portions, and other species derived from them, in the highest, with intermediate forms very numerous all through the middle portions of those deposits. But such is not the case. There are plenty species closely allied, but as certainly distinct as those in the cabinet of the conchologist of to-day; and making allowance for age and a moderate amount of diversibility, no very erroneous conclusion is likely to be arrived at in the present state of science. Mr. Darwin argues strongly that the paucity of the geological record is sufficient to account for the lack of the intermediate forms, but in the prolific strata already alluded to, as well as in others, we surely ought to find these intermediate links. But to return. It is fully conceded that mankind have succeeded in causing many singular changes to take place in the domesticated races of animals. Yet there are some singular exceptions, such as the Ass and the common Goose. What are we to argue from the fact in general? It appears to me that something more is intended to be learnt than some will be willing to admit, and it is this, that these useful creatures have been specially formed for the service of man, having been employed by him for his benefit from the earliest periods of history; and as recent testimony would seem to prove very long before. How the human race were enabled to select the particular animals now to be found in a state of domestication nearly all over the world, it were fruitless to enquire; but there are hints that they may have been directed to do so from a higher source. Be that as it may we find, that, like the human race themselves, these useful creatures are nearly all capable of existing wherever man himself can, and it is not to be wondered at, but might be anticipated, that animals so endowed should be capable of other features in their economy, fitting them more perfectly for the various useful offices they perform. A striking fact in favour of the view, that certain animals were formed for man's exclusive use, is to be found in the Camel and Dromedary, of which animals, the wild race is totally unknown; they, by their very conformation and constitution are most beautifully adapted for traversing the burning deserts of Africa and Asia, and I cannot see any approach to a creditable link between any known or extinct form, and these singular animals. Domesticated animals are dependent upon man for protection, more particularly those breeds which owe their peculiar qualities to his care and attention; and there cannot be a doubt that should they be suffered to run wild, the valuable qualities with which they are endowed would rapidly disappear, and the different breeds mingling together would cause a speedy degeneration, especially when introduced into a country which is not their natural habitat. Thus, an instance is given respecting the horse, by Humboldt, which is illustrative of this point. He says, referring to the descendants of the runaway stock originally introduced by the Spaniards into South America about 300 years ago—"In the rainy season the horses which wander in the Savannah and have not time to reach the rising grounds of the Llanos, perish by hundreds by the overflowing of the rivers. The mares are seen, followed by their colts, swimming during a part of the day to feed upon the grass, the tops of which alone wave above the waters. In this state they are pursued by the crocodiles, and it is no uncommon thing to find the prints of the teeth of these carnivorous reptiles on their thighs. Pressed alternately by excess of drought or humidity, they sometimes seek a pool in the midst of a bare and dusty soil to quench their thirst; and at other times flee from water and the overflowing rivers, as menaced by an enemy that encounters them in every direction. Harassed during the day by gadflies and mosquitoes, the horses, mules, and cows find themselves at-

tacked at night by enormous bats that fasten on their backs and cause dangerous wounds, &c." Thus animals, whose proper sphere is domestication, are found to suffer when the care and attention of man is not exercised over them. Probably, in course of time, they would become extinct.

It is generally acknowledged that, of all methods of coming to a correct conclusion as to specific identity in variable animals, none can be so much depended upon as ability to continue their kind. Thus, if the two sexes present extreme divergence of form, and the offspring resulting from their union are also fertile among themselves, no one will doubt that they are specifically identical. But it is found that many distinct species of animals are apparently much more closely allied than most of our domestic varieties, yet the progeny resulting from a forced union are invariably unprolific. This grand fact must be considered fatal to Mr. Darwin's theory. He says, (p. 274, third edit.) "That he doubts whether any case of a hybrid animal proving fertile has been truly authenticated." Strange that among so many nearly allied forms some instance should not have been brought forward by so diligent a searcher, for it cannot be doubted that these must have descended from a common progenitor, according to his theory; and, therefore, I would add, ought to be fertile among themselves.

So, in common with the great majority of naturalists, we must conclude them to be independent creations. Leaving this part of the subject, I would remark that the author of the ingenious work we are now considering, makes good use of anomalous forms in confirmation of his favourite doctrine. To mention a few. He says:—There are certain species of ducks which perch on trees, and argues that the web is a sign of incompleteness, supposing that in course of ages it would become absorbed, and the creature be improved so as to be a better percher. How futile such arguments. These birds require to perch and also to swim; and instead of finding fault (as it were) with the Creator's handy work, it would have been far better to have admired the wisdom which should thus fit a living creature for such extremes of habit. Do we not see a similar instance in some species of kangaroo, which are able to climb trees—animals which might, according to our way of thinking, be pronounced as unlikely as possible to do so. Mr. D. alludes to woodpeckers where there are no trees; but will he undertake to say that he is so perfectly informed respecting the habits and economy of these birds, that were trees to be introduced where they exist, they would be likely to make use of them. Auks cannot fly, but are they not most admirably adapted to their mode of life. Inhabiting the most barren, desolate spots, islands, often many hundreds of miles from a continent, their food consists entirely of fish, which they pursue in their native element. The wings are in a most rudimentary condition, but act as powerful paddles, which, in addition to the webbed feet, propel the creatures through, and under, the water with great velocity—a quality highly essential for securing their finny prey. It is true that many other piscivorous birds have the capacity for flight immensely developed; but, are we to argue from this that the auk is a degraded form of albatross, for instance? or that the latter is an elevated or improved auk? I think not; the perfect adaptation of everything to its peculiar sphere in the economy of nature must be admitted on every hand; and though we do not, in many instances, know the use (I might say we seldom know the use) of the various kinds of wild animals, and especially among the insect tribes; yet there is always so much of interest connected with the history of everything that has life, that a candid confession of our ignorance would appear the most rational and appropriate conduct in our present state of knowledge. Several other important points I intended to dwell upon; but as the subject is a very extensive one, I shall reserve their consideration for another paper.

The President, Chief Justice Cockle, occupied the chair, and there were present, Messrs, Bliss, Pettigrew, Diggles, Coxen, Le Gould, Wight, and Dr. Wilson.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, October 18, 1864.)

A meeting of the Queensland Philosophical Society was held on Monday, October 17, at the Municipal Chambers, Town Hall; Mr. Charles Coxen, Vice-President, in the chair. The following interesting paper was read by Mr. Wm. Pettigrew, and listened to with great attention. The essayist illustrated his observations and his theory by the production of several diagrams and models, which rendered the lecture more interesting than it is possible to make a mere transcript of it.

REMARKS ON THE WAVE-LINE PRINCIPLE IN SHIP BUILDING.

This is a very extensive subject, and one in which a person is soon liable to find he is getting out of his depth in trying to fathom it.

In referring to ancient history we find that from the time of Noah to this day people have been in the habit of using vessels to float themselves, or move about from place to place. For the purposes of flotation they have partaken more or less of the simple forms of round or square; and for moving with speed, they have been more or less sharp to suit circumstances. Illustrations of these from ancient countries, are from Nineveh—floating stones on bladders—and still practised there; and of swift boats pulled by many men, as seen in ancient pictures. In our own day there are the punts on the river, and the Rose, light-ship, at the river bar—the former of the square character, and the latter of the round character. For purposes of speed, there are our coasting steamers and ships from England. There is also another style of boat used by the islanders to the north of the continent, a model of one of which was in the School of Arts, but which has gone a missing since the fire there. It is a double boat.

The following remarks will be confined to the three last mentioned forms of vessels. I have read all the books I have been able to lay my hands on, and I have not yet found a good theory for ship building. Mr. Scott Russell laid down the theory of the wave-line. This is a correct theory so far, but very few vessels have been built according to it, for the simple reason that it affords very little carrying capacity, and they plunge very much into the water. In the "Encyclopedia Britannica" are illustrations of two vessels built by this theory, viz., the Titania and the America. In the same work are drawings of several others showing how they have tried to modify its objectional feature, by making them blunter at the bow and

stern. I have read another work by an American author, J. W. Griffiths, showing several drawings of vessels. The yacht Sylva, built in 1850, is a step in advance of Mr. Scott Russell, inasmuch as the midship section is farther aft. This author speaks very definitely in page 47, and says, "that there is no theory for building ships at all." He condemns Mr. Scott Russell and his wave line in page 33. "It has been found that at an angle of 6° on the line of flotation from the longitudinal axis or 12° with the two sides united, a wave was not generated at the highest speed, namely, 20 miles per hour, which steamboats have attained in the United States." But he gives an illustration in page 31, wherein it is clearly shown, how he contradicts himself. He says,—"Who has not often witnessed a rival steamboat holding (remaining, continuing by) at a convenient distance a much faster boat." He ascribes this fact to the power of attraction, but it is simply taking advantage of the wave formed by the faster vessel to push the slower one on.

This author is not satisfied with what Mr. Scott Russel had done, but he goes to prove the contrary and accordingly writes a great deal of rubbish, to uphold his theory that there is no such thing as a wave formed by vessels moving swiftly through the water. This is where my theory begins. I assume that any body moving through the water forms a wave or waves. That according to the size and celerity of the body so is the size and speed of the wave. For instance, a marble dropped a foot into water will give one size and speed; a pound weight from 3 feet gives a larger and quicker wave; and a stone of 200 lbs. weight dropped from 10 feet high will give a still larger and quicker wave. So with vessels of different sizes at the same speed, they will have waves with different speeds, and a vessel at different speeds will form different sizes and speeds of wave. This will ever be a difficulty in designing vessels, as steamers for instance are always lighter at the end of their voyage, and sometimes they are sunk far below their regular draft by cargo, and sailing vessels on the other hand cannot command the wind to drive them at their proper speed.

Coming back again to dropping a marble into the water. It displaces so much water; that goes off in a ring, then the water gathers together and rises up beyond its original level over where the marble entered, then it drops at the same time another ring is being formed further out. This is repeated for some time, but every time getting less; at the same time circles are extended farther and farther away, but also getting less and less. The same is true of a vessel with a wave-line for her bow, moving through the water. No break is formed; the water is raised up by the bow of the vessel pressing it to one side, when the full width of the vessel is in, if I may so speak, the wave recedes, but the re-action immediately sets in and another one forms; and, after it others—getting less and less. My principle is, to form the sides of vessels straight for the length of the second wave, and let the third wave fall into the run—*i.e.*, the after part of the vessel. Advantage may be taken of the second and third waves, and let the fourth fall in behind.

Such is the theory. I shall now quote a few examples, proving that it is correct. These are not to my satisfaction; but, still the best I can get. In this American work on ship-building, page 133, and plates 19 and 20, are descriptions and drawings of the ship Universe. Of her this author says, "The Universe, while building, was visited by the sceptical and the curious; and it would have been no difficult matter for a practised eye to have read from the observer's glance, the shake of the head, or the shrug of the shoulders, that she was set down by both shipbuilders and masters as a ship that would be partially if not wholly unmanageable. In a word, that fast sailing and good steering were entirely out of the question. The ship was finished, notwithstanding, and has completed her first voyage, and is found to roll remarkably easy, steer well, and sail fast; as some shipmasters have abundantly proved who were sailing in company." The reason of her speed and other good qualities is her having a straight piece in her middle, opposite the second wave, and the third wave falling in behind. Her speed would have been better had she a finer bow, at the expense of a bluffer stern. The model exhibited is, in my estimation, superior to her.

The next one I will refer to is the Telegraph steamer. This steamer, some years ago, traded between Sydney and some southern port—Melbourne, I believe. She was what I would call a vessel with two ends and no middle. he

took very little cargo, and was what sailors call very wet, *i. e.* continually dipping her bow into the sea. She was lengthened amidships by making a part in her middle perfectly straight, that is, where the second, or second and third waves rise up, leaving the third or fourth to fall in behind. The consequence was that she attained the same speed, with the same power and draught of water, and took 200 tons extra of cargo.

Since then the A. S. N. Company have lengthened several of their steamers in the same manner, and all with advantage. I have been told that none have been more improved than the Clarence for being lengthened. I noticed the Boomerang at the wharf the other day, and she looks quite another vessel entirely from what she did before being lengthened.

I will now refer to a boat—the Meeanchin—I had built about a year ago for a special purpose, viz., light draught of water, and speed. When doing so, I thought I would carry out this principle. I, however, overstretched the mark. She is too full aft for any speed that can be attained by pulling. A few days ago I had the opportunity of trying her with a sail. I had another boat with me. Going before the wind, about five or six miles per hour, the two kept very near each other. But when the wind blew a little stronger the Meeanchin went away from the other; but as if she had never moved. The resaon was that the second wave rose at the straight part, and the third wave fell in behind.

With reference to the double boats of the Islanders, that go at eighteen to twenty miles per hour, the principle is the same. The wave formed by the bow is reflected by the little boat on the weather side, and falls in behind.

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THE

ANNUAL REPORT

OF THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

1864.

WITH

THE PRESIDENT'S ADDRESS.

BRISBANE:
PRINTED BY G. WIGHT, "GUARDIAN" OFFICE.

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SECRETARY:

Rev. J. Bliss.

QUEENSLAND

PHILOSOPHICAL SOCIETY.

ANNUAL MEETING HELD ON MONDAY, DECEMBER 12, 1863.

(From the *Queensland Guardian*, December 13, 1864.)

The above society held its annual meeting on the 12th December, in the Municipal Chambers, Chief Justice Cockle, president of the society, in the chair. There was a good meeting of members present. The minutes of the previous meeting were read and adopted, and other business transacted. Dr. Waugh enrolled his name as a member of the society, and thereafter declared by the president to be a member of the society. Mr. Armand Ranniger, Kangaroo Point, was proposed as a member.

The SECRETARY said, when on a visit to Sydney, he attended the Philosophical Society of Sydney, and had proposed that papers should be exchanged; but, whilst they approved, yet they could not exchange, owing to their papers not having been printed. He suggested that the society should decide what should be done in the way of purchasing books and specimens when they came under notice, between meetings.

A small committee was formed for the purpose of drawing up a list of books, necessary to enable the society to carry out its objects, in order that a sum of money might be laid out in this way.

Mr. Rawnsley is expected to read a paper on the "Bower Bird," at an early meeting of the society.

The SECRETARY read the following interesting :-

REPORT.

"According to the 17th bye-law, the council is called upon to report to this meeting the present condition of the society, and the progress which it has made during the past year, and in doing so it appears there is ground for congratulation in three respects. First, regarding the financial position of the society. Second, regarding the increased number of members. Third, regarding the progress made in the real work of the institution.

"1. With regard to the finances, the Treasurer's balance sheet will speak for itself, showing that the council have exercised the greatest economy with the funds entrusted to them, and that there is, at the present time, a balance of £——— still remaining in the Treasurer's hands.

"2. With regard to the increase in the number of members, the council have to report that, during the year, the members have nearly doubled, which of itself affords proof that the society has not been behind that general progress which has marked our colonial history during the year which is now on the point of closing. The council is nevertheless called upon to refer to the removal by death, of one of the older and most active of our members, viz., Mr. T. S. Warry, whose loss will be deeply felt by them, as well as the many other societies with which he was connected.

"3. With regard to the general work of the society the council have an equally favorable

report to make. During the year nine meetings have been held; at which eight papers have been read by members of the society; and at another meeting a revision of the rules was considered at length, and ultimately agreed upon.

"The following is a list of papers read before the society during the year: 1. 'Comparative Meteorology,' Mr. Bartley; 2. 'Geographical and Geological Observations in Northern Queensland,' Mr. Le Gould; 3. 'On coral Islands,' Mr. Boyce; 4. 'On the habits of the Regent Bird,' Mr. Coxen; 5. 'The Geology of Western Queensland' (communicated), by Mr. Wilson; 6. 'Thoughts suggested by the theory of Mr. Darwin,' Mr. Diggles; 7. 'On the habits of some of the spiders,' Mr. Bartley; 8. 'Remarks on the wave-line principle in ship building,' Mr. Pettigrew.

"From the foregoing it will be seen that the attention of the Society has been chiefly directed to the natural features of our own colony, with a view to make known as widely as possible the advantages by which we are surrounded, and the sources of wealth which only require knowledge and labor to render them available to the community. The papers which have been read may be thus epitomised: On the Climate of Queensland, 1; on the Geology of Queensland, 2; on the Natural History of Queensland, 2; and to these must be added three valuable papers on subjects whose interest is not so immediately confined to our own colony, viz:—Mr. Boyce's paper on 'Coral formation in the Maldives;' Mr. Diggle's paper on the 'Darwin Theory;' Mr. Pettigrew's paper on the 'Waveline principle in shipbuilding.'

"Communications have also been received and read from Mr. Tiffin, on the 'Blast furnaces of New South Wales,' accompanied with specimens of slag; and from Mr. Grimaldi, of Bowen, on the 'Structure of the cell of the native bee.' Some of the papers have been accompanied by specimens in illustration of the subjects treated on, which have in most cases been presented to the museum. The council feel that the thanks of the society on this account are specially due to Messrs. Tiffin and and Le Gould.

"Whilst on this point the council cannot abstain from expressing regret that the contributions to the museum have been very limited; it would be difficult to overrate the value of either a public museum or library, and as it involves a vast outlay of time, labor, and money to accomplish either of these objects, present efforts are far more valuable than the promises of future help.

"With regard to the society's file of meteorological observations, taken at Brisbane, the council must report the severe loss sustained in this respect by the death of Dr. Barton, to whose unwearied diligence and scientific accuracy we are deeply indebted. It may, possibly, be necessary to recommend some plan whereby the loss thus sustained may be made up.

"The society is also indebted to Mr. R. B. Sheridan, of Maryborough, for regular contributions of his meteorological observations taken in that town.

"In conclusion, the council would venture to suggest, as a topic of immediate importance, the study of the natives of Queensland, their language, religion, and the knowledge which they possess of the natural productions of the soil. An accurate and comprehensive treatise on their language and religion, although it might not be of commercial value, would be a vast acquisition to the linguist and ethnologist, and would do much to remove the reproach under which we now labor, viz.,—that whilst the native can learn our habits, manners, and customs, we are unable to detect the spark of Divine intelligence which lies, to us, concealed beneath his swarthy skin.

"To us, as a community, the knowledge the native possesses of the natural productions of the soil may be of more general value. There can be no doubt that they possess much knowledge of the medicinal properties of herbs, which are unknown to us even by name or sight, and of roots which have long since supplied them with the staff of life; and, besides this, their very nature and mode of living must have made them familiar with the habits of birds, animals, and fishes, some of which are unknown even to the most accomplished naturalists. No stronger illustration of this could be given than the fact which was discovered about a year ago by Mr. Waller, the taxidermist, and communicated to this society in a paper read by Mr. Coxen, when, for the first time, it was made known that the regent bird belonged to that class of birds known as bower builders. We cannot close our eyes to the fact that the field, whence we may reap this small yet very valuable harvest from the store of learning possessed by the native, is daily decreasing, and it is hardly too much to anticipate that not long after the last Sydney native has gone to his rest we shall have the last Brisbane native known amongst us as the only remaining representative of his tribe."

The President of the Society (His Honor Chief Justice Cockle) then read the following

ANNUAL ADDRESS.

I am not aware that there is anything in the report of the council which demands further remark from me. The society will appreciate the labors of Mr. Bartley, Mr. Le Gould, Mr. Boyce, Mr. Coxen, Mr. Wilson, Mr. Diggles, and Mr. Pettigrew—of Mr. Tiffin, Mr. Grimaldi, and Mr. Sheridan, who, by interesting communications, have furthered its objects. I ought, however, to advert to a short paper drawn up at my request by Mr. Diggles, and handed to me privately. That

paper contains a remarkable example of the application of the notion of final causes, and merits an attention which other matters have hitherto prevented me from bestowing upon it. I hope, ere long, to recur to this paper, which is the expansion of an instructive remark made by Mr. Diggles at one of your meetings. As to our society itself, I hope that each year will see it approaching more nearly those proportions which a similar body has attained in a sister colony (Victoria). If all the aspirations of dwellers in this part of the world are not to be limited to that material prosperity which, exclusively aimed at, leads to moral degeneracy and national decay, the importance of such an institution as this can scarcely be overstated. In a country where but little exists to remind us of those halls and schools in which learning and science are cherished at home, it surely is no slight matter to have organised a meeting, in which lovers of science can exchange their ideas, expound their views, and knit more firmly their social ties, and to which they can communicate their researches; researches which, if I am not mistaken, may one day be found to have a more than local interest. However ambitious the name which we have assumed may seem to some, there are those among us who will strive to render our society worthy of its name. It seeks not merely to receive, to read, and to register the communications, however interesting, of its members, but it also seeks, by discussion, to further the ends of research, and, more than that, to give to research a tone and direction. For myself, I am of those who would wish to see the society embrace the largest possible field of topics and enquiry. And regarding, as I do, philosophy and history as the two lakes in which, however turbid in their course, the waters of science at length rest clear and tranquil, I ventured, in my first annual address, to advert to the subject of scientific history. For the most part, and as a general rule, the man of observation should also be a man of reading; otherwise his powers of observation may be directed to that which, however interesting to himself, has been observed by others over and over again. The same powers employed in another direction, might lead to results of permanent and wide-spread value. Nothing is more to be wished than that the philosophical and historical devotees of science should bear in mind the words which Thibaut addressed to the corresponding devotees of law:—"Without philosophy there is no complete history; without history no safe application of philosophy. Both must unite as aids to interpretation, and must exercise a continual influence on each other. The jurist who aspires after perfection will therefore endeavor to combine profound historical knowledge with philosophical views; for the historical part of jurisprudence can never be separated by a sharp line from the philosophical. In each are gaps which can only be filled up by the aid of the other." These remarks are not applicable to law only. Perhaps many a dull school-book might, by a little infusion of historical information, so be vivified into an interesting manual. It is only in the infancy of societies, as in the infancy of individuals, that any great amount of leisure is in general afforded for abstract speculation on matters not directly or immediately connected with the practical work of their existence; and as we at the present moment do not lack the leisure, I avail myself of it to take a rapid glance at that tree of science of which the society, by its very title, proclaims itself the fosterer. Even were we to regard science and art as envious rivals, and not as allies interlaced by a thousand ties, the task of defining each would not be easy. It is not my object here to draw a distinct line between them, but rather to point out how dim and shadowy is their common boundary. The subject matter of a study is not in itself sufficient for enabling us to decide beyond dispute whether we are considering an art or a science. Thus, by way of example, the subject of contemplation may be number. But we may consider number under such an aspect as, on the one hand, to evolve a science of number or a theory of numbers, or, on the other hand, to deduce practical rules which form, properly speaking, portions of an art of computation, or of an art or method of bookkeeping, &c. Again, space or some of the conceptions arising out of it, underlie at once the science of space, i.e., geometry, and the arts of surveying, of mensuration, &c. Logic, so far as it analyzes the processes of the mind in reasoning, is a science; so far as it furnishes us with practical rules to secure the mind from error in its deductions, an art. And, so far as it combines itself, in its exercise, with rhetoric, it partakes still more closely of the character of an art. The subject-matter then, alone, is not the test of art or science. We must take into consideration the final cause, end, or object in view. When such end in view is the manufacture or production of some material object, or some mechanical result, or some emotional state, we are in the field of what are called the mechanical arts, or the fine arts, according as their office is to minister to necessity or convenience, or to gratify taste and feeling. I find that Professor Cayley has recently said that algebra is an art and a science; *qua* art it defines and prescribes operations, and *qua* science it affirms *a priori*, or predicts the results of operations. This of Mr. Cayley's is one view of the meaning which in strictness the terms art and science should respectively bear. There is another, not perhaps essentially different, in which science and art may be likened respectively to theory and practice.

Science, like theory, is a systematical statement of rules and propositions; art, like practice, is the application of any of these rules or propositions. But if we reflect that the theoretical rule will in many cases be moulded so as to meet the practical object, the reaction of practice, or art, on theory, or science, is at once suggested, and with it the difficulty of eliminating, in all cases at least, a practical element from theory. I have made these observations with a view, not to open, but rather to close any discussion of the distinction between the sciences and the arts. The arrogant levity which should despise, or affect to despise, the latter, I do not expect to find among my hearers. But if there be any scientific purists who think that it is in itself desirable to make the chasm between the sciences and the arts as wide as possible, I would by an illustration show how difficult is the task of dissevering them. Take the case of arithmetic. In this case there are no doubt propositions which, for their enunciation or conception, need no material or mechanical aid whatever beyond clothing them in words. Such a proposition is this, that "the sum of two numbers multiplied into their difference is the difference of their squares." But on the other side there are numerous arithmetical questions which no one would dream of performing, except by organised processes, and with the aid of the current notation. Now this notation being arbitrary, and the digit 5 for instance, capable of representing any other number, and on any other scale of notation, we see that an arbitrary or artificial character, a character which, in a certain sense, would justify us in calling arithmetic an art, tinctures that science. If we apply the term mechanical in a general sense, and to denote any process that is not purely mental, and if, moreover, we proscribe anything mechanical, whether in the subject matter, the end in view, or the processes of deduction by which that end is attained, we shall leave little to which the term science can be strictly applied. Pure geometry indeed might be placed in the category of sciences, for the diagrams of geometry are not, like the symbols of algebra, arbitrary symbols, but, at least, in plane geometry, direct representations of the conceptions which they are intended to suggest to the mind. I shall now, however, use the term science in that sense with which I may presume my hearers to be familiar, merely reminding them that, while they view with distrust attempts to divorce the very name of art from science, they should lend no ready ear to those who think that art can flourish where science withers, and that, under the epithet of "verbal truths," her teachings can be placed in an unfavorable contrast with the deliverances of practical men, or remitted to a despised obscurity. That "one and one make two" may look like a verbal truth; but he would be rash who would venture to say that the proposition that "three times three added to four times four, is equal to five times five," is so. It may not be unlikely that the man who would make such an assertion would be led into a hasty and false generalization of the proposition in question. The sciences may be conveniently divided into three divisions. 1. The mathematical sciences; 2. the natural sciences; 3. the graphical sciences. In the case of the mathematical sciences, so far as they are mathematical, their truths are capable of being verified without any appeal to experience; although, of course, we may appeal to experience, if we will. Thus, in order to find the sum of the three angles of a triangle, we may measure and add them, unless we are satisfied with the apodictic proof that their sum is two right angles. The mathematical sciences are either (1) *pure* or (2) *mixed*, in which latter case the science is also a physical or a graphical one, or both. The pure mathematical sciences have for their subject matter pure conceptions of the mind, such as number,—conceptions which have their seat in that portion of the mind, which there is authority for calling the understanding. The pure mathematical sciences are arithmetic, lógic, algebra, the differential and integral calculus, the calculus of finite differences, the calculus of functions, &c. These may be called the logical sciences. There is another branch of pure mathematical science, in which the conceptions which form its subject are not—like number—pure conceptions of the understanding, but, on the contrary, are representations of something exterior to, and independent of, the mind, and which, partaking of the qualities both of conceptions and of perceptions, may conveniently and briefly be called perconceptions. The perconceptions are two in number—namely, space and time. The former is the subject matter of geometry; the latter, of Sir W. Rowan Hamilton's (of Dublin) science of pure time. These two sciences may be called the intellectual sciences, inasmuch as there is authority for calling that faculty which is the source of the ideas of space and time the intellect. By a combination of the logical and intellectual sciences, we arrive at the sciences of analytical geometry, analytical trigonometry, the calculus of quaternions, &c. These may be called the logico-intellectual sciences. The logical, intellectual, and logico-intellectual sciences comprise the pure mathematical sciences. I find that the topics presented to myself, and the limits within which such an address as this must necessarily be contained, prevent me from filling up the sketch, which, when I commenced, I thought I might have rendered more perfect. I shall therefore content myself with such remarks as I have time to make, and reserve until a future communication to the society the residue of the scheme. I may say, however, that by the term graphi

cal sciences I mean those which either deal with delineations of a material object (as Geography), or in which we seek to define certain objects by marks (as Botany, according to the system of Linnæus, Mineralogy, &c.). In the graphical sciences the primary object is classification or delineation; the special characteristics of the things classified or delineated depending in part, at least, on other sciences (ex. gr.: Mineralogy calls in chemistry, and Linnæus's system would be a mere system of marks, as compared with a natural or a physiological system of botany). In Astronomy we see a science that has passed from one class to another of the sciences. Until the motion of the planets was observed, Astronomy might, save for the moon, have been purely a graphic science, and a map might have been made to comprise all our knowledge of the skies. As the motions of the planets were observed, astronomy became a physical science, in the sense of a science depending on observation, and at last the discovery of gravitation removed it from one class of mixed mathematical sciences to another, *i.e.*, raised it from a science of observation to the rank of dynamical science. And here, as we leave this outline, I think I may express a reasonable conviction that the progress made by the society during the past year is such as to afford a favorable augury for its continued prosperity.

The following is the list of the officers for the year 1865 :—

Patron : His Excellency Sir G. F. Bowen, K.C.M.G., &c. President : His Honor Chief Justice Cockle. Vice-President : Charles Coxen, Esq., M.L.A. Treasurer : Alexander Raff, Esq. Auditors : Rev. R. Creyke, and Mr. G. M'Donnell. Council : Mr. H. C. Rawnsley, Mr. S. Diggles, Mr. C. Tiffin, Rev. J. Bliss, Rev. B. E. Shaw. Secretary : Rev. J. Bliss.

BRISBANE:
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1864.

QUEENSLAND
PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, April 12, 1865.)

At a meeting of the Queensland Philosophical Society held on Monday April 10th, the following paper was read by Mr. Rawnsley :—

The highly interesting paper on the Regent Bird (Sericulus Chrysocephalus), by our Vice-president, Charles Coxen, Esq., M.P., recently read before this society, in which, for the first time, the scientific world are made acquainted with the bower-building habits of the bird, has led me to bring before the meeting this evening a brief paper on another of the family—the Satin Bird (Ptilonorhynchus Holosericeus.)

The great ornithologist, Gould, was the first to give a scientific description of it, and that so ably, as to leave little for others to add. There are some points in its economy on which we are still in the dark, and towards the clearing up of which I can give a little information. I allude to the breeding and formation of the bower.

Although the bowers of the Satin Bird vary in size, to some extent, I think no doubt will remain on the minds of those who have the opportunity of comparing the bower exhibited by Mr. Coxen as that of the Regent Bird with that now before you, of their belonging to birds of different species. The fact of the Regent Bird being known from the earliest days of these colonies without the discovery being made that it had the same extraordinary habit as the Satin Bird, in no wise casts a doubt on the matter ; for to the regret of ornithologists, the nest of the Satin and Regent Birds are still unknown, though able and ardent naturalists have searched for them in all localities. Once I felt that I was in the close vicinity of that of the Satin Bird. In one of the deep glens of that romantic mountainous district, the Illawarra, under the overhanging boughs of a beautiful streamlet, I found the bower of a Satin Bird. It was so placed that the bird flying down the stream could enter the bower, which was almost at the edge of the bank, and a small opening in the dense foliage, gave a passage to it from the forest. At its mouth was a large quantity of the tail feathers of the "Lowry" (*Platycercus Pennanti*). A great Eucalyptus was within a few feet of it, and in that tree were several females and young birds. One of these had a grass straw in its mouth ; was this bird building in the gum-tree? None of the natives to whom I have spoken, and offered every inducement which I thought might tempt them to bring me the nest, have been able give me any information on the subject.

"The egg is supposed to be blue," says Dr. Bennett, writing of the Regent Bird, in his "Gatherings of a Naturalist in Australasia," but he gives us no ground for the supposition, and he adds, "if this should be the case, it will be the only bird with a blue egg in Australia." In this latter statement he is in error, the egg of Sphenostoma Cristatum is blue; anything more beautiful than the nest of this bird can hardly be conceived. In the solitude of the Salt Plains, near what was formerly known as Lake Torrens, this bird breeds in numbers in the dwarf bushes. In one I found a nest made of fine twigs and everlasting flowers (*Xeranthemum)*, and in it four blue eggs. The egg of *Meliphaga Tenuirostris* is also blue. To resume—it is somewhat singular that the eggs of these birds should not have been found in females on dissection. Now, I think that I can safely say, that I have examined some hundreds without in any instance, finding an appearance of breeding; and this applies to birds killed in Victoria,* New South Wales, and Queensland. The great stronghold of the Satin Bird is, without doubt, the Illawarra and Gipps' Land; there the bowers are found in great numbers, and there the birds are seen at all seasons. I have not resided there the whole of any one year; but have passed months at intervals. My experience leads me to think that the bird builds there in the vines and in the vicinity of the bower.

With us the Satin and Regent Birds are migratory, the Satin Birds making their appearance in April or May. They are then a mixed flock of adult males, females and young birds; but at other seasons of the year I am inclined to think that the old males separate themselves from the flocks; for some years ago, down on Narang Creek, at the south end of Moreton Bay, I killed a dozen blackcocks feeding on the flowers and seeds of the nettle tree (*Urtica gigas*) without once seeing a female. The fact of there being districts in which the birds are seen at all seasons of the year is not, I admit, a proof of their breeding there. Pelicans are seen all the year in Moreton Bay, but the eggs have never, that I am aware, been found there, and the natives deny that they breed in the islands.

The nest of the Cat Bird (another of the family) has been found, and I had the good fortune to see it. It was obtained in the dense vine scrubs of the Clarence. It measured about nine inches across, was hemispherical, and made entirely of the fine native vines; unfortunately the bird had not laid. This bird breeds with us. I have seen the old birds feeding the young in the Three-mile Scrub.

The specimens of the Satin Bird, and the bower in the case now before the meeting, were obtained at Witton, on the River Brisbane, a few miles from the city. The finding of the bower of the Satin Bird in this district is a very rare occurrence. I have ranged the scrubs here for many years without seeing or hearing of one being found; and this again is, to some extent, negative evidence for the Regent Bird; for, as that is likewise a migratory bird it may only rarely form its bower in the settled or disturbed districts.

There is another interesting fact disclosed on a close examination of this bower; it is not the work of one season—the greater portion is old—but the birds were repairing it when I killed the old cock. They had been noticed in considerable numbers there two seasons before. There were no shells nor feathers; the absence of the latter may be accounted for by the birds having only recently commenced putting it in order. The feathers accumulated the previous season would be carried off by birds for their nests. In other localities, however, the bowers are found beautifully adorned. I will, before quitting this part of the subject, mention one which I found in the Illawarra. There was a platform of twigs about a yard square; this was covered with bright green moss growing between the interstices of the platform; and in the centre the most perfectly finished bower that I ever saw. The twigs of which it was formed were slender and unbroken, arching over, nearly meeting at the top, about the same height as the present, and quite new. It was decorated with feathers and snail shells, and, among other things, a piece of "willow" china. The black cock is constantly shifting the feathers about the bower, and after fixing one, stands erect, glances proudly around, and pours forth his loud liquid call. The bower is not the work of one bird; all the family appear to join in its construction, and either race through and about it, or sit on the boughs overhanging it, uttering a peculiar grinding note, while the black cock is performing all sorts of antics in and about it.

* The Regent Bird is not found in Victoria.

The black cock rarely absents himself above a few minutes, for his rivals are great thieves, and a desperate fight takes place when some rascal has been caught plundering. Anything that is attractive is carried off by them. I have not, however, been so fortunate as to fall in with that gigantic species, mentioned by the Rev. J. G. Wood, in his "Illustrated Natural History," "which has been known to steal a stone tomahawk." (!!) The food of this bird is at some periods almost wholly vegetable. They, in common with almost every bird, eat animal food, and at early morn may be seen in flocks, running up the boughs of the giant Eucalyptæ which overtop the scrubs, feeding on the insects. With, as at certain times, they feed with little exception on plants growing on swampy ground, when a hundred may be seen without an adult male among them. The numerons fruit-bearing trees of the scrubs are their usual source of food, and among them a gr at favourite is the fig. It is unnecessary to give a description of the plumage, for it has been most ably done by Gould. Suffice it to say, that in common with most birds the males do not, it is believed, obtain the splendid plumage which gives the bird its name before the third year. The young males resemble the females, except being a little darker on the breast. With the acc ssion of plumage comes extreme shyness; and so changed and peculiar is the sound of the wings that from practice I could always tell where an old cock flew or rose from the ground, although the thicket was too dense for me to see him. The change of plumage is accompanied by that of the color of the bill and legs. Both become white. The eye does not undergo much alteration; an increased brilliancy may be noticed. It is of a most beautiful ultramarine blue, shot with magenta, radiating from and encircling the pupil.

Printed by G. Wight, "Guardian Office," Brisbane.

QUEENSLAND

PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, May 10, 1865.)

At the monthly meeting of the above society held on Monday, May 8, Chief Justice Cockle, President of the society, read the following paper :—

His Honor said :—The theory of Leibnitz tends to bring into conformity the notation of algebra and of the differential calculus. The substantial connection between the two sciences is more clearly manifested in the solution of linear differential equations with constant coefficients, and in that integral, the discovery of which, by Euler, was the first step towards the foundation of the theory of elliptic functions. The approach of the two sciences is further traceable in the researches of Abel and of Jacobi, of Galois, of Hermite, and of Kronecker. Some time before leaving England, I showed that the solution of an algebraical equation of any degree (or, what for the moment I shall treat as a synonym, of any order), may be made to depend upon that of a linear differential equation, of an order inferior by unity to that of the algebraical equation. These differen ial equations are now known by the name "differential resolvents," and I certainly thought that they would be found to yield to some known process of solution, as, indeed, the resolvent of the imperfect cubic did. But a distinguished writer on the subject of algebraical equations, Mr. Harley, (now) F.R.S., who took a great interest in the subject, and calculated certain higher differential resolvents, found that in general (and this remark applies to that of the imperfect biquadratic) they were not directly soluble by any known method, and he discovered that the resolvents of certain trinomial equations take peculiar forms which may be regarded as additions to the primary forms of Boole. I am now, I believe, able to announce the following results in the theory of linear differential equations. (1.) I have been led to an *a priori* demonstration that the

general linear differential equation of the second order is absolutely insoluble by any finite formula involving only algebraical, exponential, logarithmic, or trigonometrical expressions, or indeed any expressions whatever capable of being derived by indefinite integration from algebraical or exponential functions:—and this impossibility subsists even although the derived functions be supposed to be affected in any way whatever, and any finite number of ways whatever, by signs of indefinite integration. The demonstration of the impossibility of solving the general linear differential equation of the second order I arrive at by pushing one step further the reduction of equation (128) of art. 77 of my "Notes on the Differential Calculus," in vol. iii. of the *Messenger of Mathematics*. On expunging the traces of the independent variable (128) takes a form, the solution of which is impossible. (2.) The second and third terms of a linear differential equation of the third order can be simultaneously destroyed if we assume the solubility of a linear differential equation of the second order. If we simultaneously change the dependent and independent variables, form the conditions, and eliminate properly, we shall be led to a linear differential equation of the second order, in which the dependent variable is the square of the modulus (or factor) in the factorial substitution by which the dependent variable is supposed to be changed. (3.) The class of algebraical equations which lead to homogeneous differential resolvents are not necessarily wanting in their second term: the resolvent is homogeneous if each root is a linear and homogeneous function of other roots. (4.) I have arrived at various new, as I believe, and comparatively general forms of soluble linear differential equations of the second order.

The Chief Justice added that other engagements or occupations had prevented him from drawing up any formal paper embodying the above results. But he hoped that, in a scientific point of view, they would be found of sufficient interest or importance to justify him in making the foregoing announcement to the society.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, November 13, 1865.)

The following interesting Paper on the above subject was read by Dr. WAUGH at the last meeting of the Queensland Philosophical Society :—

A ray of common white (solar) light, when broken up by transmission through a prism, presents to the naked eye nothing more than the rain-bow of colors, with which all are familiar ; but if, by means of a telescope arranged as in the instrument shown, this spectrum be closely examined, certain dark hues, of various breadth and intensity, are seen extending across it always in the same position. These were first observed, or at least described, by Wollaston and by Fraunhofer of Munich, in 1814, and the principal ones noted by the latter, as A, B, C, &c., to the number of seven. These hues were, at that time, estimated to amount to about 600, but since then have been observed in much greater numbers. They are generally known as "Fraunhofer's lines."

My object, in the few remarks I propose to make this evening, is to call attention to what, though now no novelty, still possesses an ever-increasing interest, especially for those engaged in analytical researches. The fact to which I allude is, that if, in place of the solar spectrum, we examine that of any flame, we find, that, for the dark lines above-mentioned, are substituted bright, colored bands, varying in color, position, and intensity. according to the substance introduced into the flame. It has long been known that flames colored by the introduction of different substances, are modified when viewed through glass of different hues.

Thus soda gives to flame on orange-yellow color, which, though visible through green glass, is invisible through blue. Lithia gives to flame a carmine red color, which viewed through violet glass, appears, violet, through blue glass red, invisible through green.

Baryta gives a yellowish green color, which appears blue-green through green glass.

Strontia, giving a purple colour, appears rose-coloured through blue glass.

But this method is very rough in comparison with the more recent method, I am about to describe—which indeed is so delicate that all others at present known, are coarse in comparison—that is, for purposes of qualitative analysis within its scope. The ease with which it may be applied, and the rapidity with which certain substances may be detected, will always recommend it. If a

ray of solar light be transmitted through a small slit aperture covering the object glass of a telescope, and received on a prism for reflection, and thence through another telescope to the eye, as in the instrument on the table, and the position of the principal dark lines noted, and their relative distances measured, so that a diagram may be drawn upon paper for reference, we shall possess a key, by which to detect differences that may exist in the spectra of other incandescent bodies. I may just observe that all solid or liqu d bodies give spectra containing no dark lines, but colored bands, as follows :—

If we introduce into a flame of moderate luminosity, a small portion of any metal, or salt of a metal, we shall immediately see the bright colored bands characteristic of such metal, and always occupying a definite position in the spectrum. The diagram on the table shows, roughly, some of these phenomena. It is copied from one figured in Hoggendorf's "Annalen," and published in the "London Edinburgh and Dublin Philosophical Magazine," and some of the facts stated in this paper, are taken from the same source. If several substances be present at the same time, we see indications of all of them; there is no ma-king their presence as in most analyses by the ordinary chemical re-agents.

By this means several new metals have, of late years, been discovered,—for instance the alkaline metals Cæsium, showing, in the spectrum, bluish grey lines—and rubidium, showing two red lines, by Bunsen, in 1850. He evaporated some fifty tons of the Dürkheim and Baden waters, to procure 200 grains of solid matter, which proved to be two new metals, bearing a proportion to the water of one to about six milli n parts. The latter metal, has been shown, by Grandeau, to exist in the ashes of beet root, tobacco, coffee, grapes, &c., &c. These metals cannot by ordinary chemical tests, be distinguished from potassium, excepting that the double chlorides of Platinum afford very different degrees of solubility, while the carbonate of cæsium is soluble in alcohol, thus affording a distinction from all other alkaline carbonates. A hot spring in the Wheal Clifford mine, in Cornwall, contains cæsium, and is the only water in England in which it has been discovered. In 1861, Crookes discovered thallium, showing, unlike other substances a single line in the spectrum (light green)and that not coincident with any dark solar line. This metal is almost identical with lead in respect of color, specific gravity, softness, fusibility, specific heat, &c., and even in its poison symptoms, though Thallium is far more violent in its action. An ingot of this metal was exhibited lately (at General Sabine's conversazione) by Bell Brothers, weighing some 6000 grains.

Professor Richter of Freiburg, in Saxony, discovered in a zinc ore in the Hartz, Indium, giving indigo, colored bands.

Lithium, discovered in 1817 by Arfredsen, in the mineral petalite, was believed to be very rare, till Bunsen and Kirchoff, proved it, by spectral analysis, to be a most widely diffused metal, existing in almost all mineral waters, in tea, milk, human blood, and the ashes of some plants. This metal was detected, by Dr. Bence Jones, within a quarter of an hour of its exhibition, in the cornea, and in the cartilage of the hip joint. Sodium, showing one of the brightest, and most easily demonstrated lines in the spectrum, is nearly always present, from its almost universal distribution, being carried, no doubt by the wind, from the sea spray, to long distances. An instance of the very general distribution of sodium, and of the delicacy of this means of detection, may be thus afforded. If a spectrum be obtained tolerably free from the sodium band, and a dusty book, or some such article, be shaken at a considerable distance from the lamp, the characteristic golden line, corresponding to the line D of Fraunhofer will instantly become visible. Dr. Frankland has discovered this line when only a three billionth of a grain of sod um was present.

I may just mention, in passing, that, minute as are the quantities appreciable by our present instruments of spectrum analysis, still more minute quantities are rendered evident by a method adopted by Professor Tyndall. to ascertain the power of certain gaseous substances to absorb and radiate heat. In the instrument used, a quantity of boracic ether, equal to a pressure of only a thousand millionth of an atmosphere, is readily appreciable, when only three fourths of a degree of heat centigrade is imparted to it, deflecting the galvanometer needle 14 degrees.

It must n t be thought, however, that metallic bodies al ne can be, by the above means, detected; for though their spectra are the most evident, as, for instance, in tobacco, where we find the spectra of lime, lithium, potassium, rubidium, and sodium, yet carbon, as shown in oxy, hydro, ni ro, and sulpho-carbons, gives a spectrum, the prevailing color of which is blue. Again, blood gives a spectrum containing colored bands, not at all dependent upon the iron contained.

Referring to Professor Tyndall's experiments, the field open for investigation in the matter of luminous and heat rays in combination is very great, for when we consider that of the dazzling white light of platinum wire heated in the electric arc, only five per cent., of coal gas flame four per cent., and of the electric light itself only ten per cent., are luminous rays, the rest being invisible rays of heat; and that these heat rays may be concentrated by lens upon any combustible body, and, in their turn, produce igni ion and light, and thus may be produced out of darkness, light which, according to Professor Tyndall, may equal that of

the sun in intensity, we may well feel certain that we have but initiated experiments, which others coming after us, will follow up with energy, and that results will be arrived at, of which, at present, we can have no conception.

Stephenson had more than a glimmering of the truth when he said that the locomotive engines, with all their immense power, were driven by sunbeams.

In a paper having more pretension to systematic arrangement or to regular treatise, one would enlarge upon the theory, generally accepted, as to the cause of these colored bands in the spectrum, *i.e.*, that the vapours of the respective substances have the property of absorbing light of the same degree of refrangibility as their own, and of transmitting all other —and this to such an extent that, by placing behind the flame under examination, any incandescent body giving a continuous spectrum of sufficient intensity, we reverse the spectrum of the former substance and change the colored bands into dark ones. Hence we conclude that the dark lines in the solar spectrum are the reverse of what the solar atmosphere would present if there were not behind it a most intensely heated body, reversing what would otherwise have been colored bands, and rendering them black.

From this we deduce that the sun is really an incandescent solid body. Further, upon ascertaining what substances give colored bands corresponding exactly with the dark lines in the solar spectrum, we arrive at a knowledge of some of the components of the solar atmosphere, and consequently of the sun itself.

The spectra of some stars and nebulæ would seem to prove that, in many nebulæ, there is no solid nucleus. Further observations are, however, necessary in spectrum matters, for, in a letter to the editor of "Cosmos," M Moren states that the spectrum of iron, as shown by a Bunsen's battery of 65 elements, gives lines almost innumerable—that the yellow lines of sodium are found in the spectrum of mercury; and Dr. Frankland finds the lithium spectrum exhibiting a splendid blue-line like strontium.

A paper by Mr. Alexander Waugh was read at the meeting of the British Association at Bath, in 1864, upon the spectra of *Polarised Light*, which contained some curious discoveries in connection with this subject. The instruments used by some observers are, in power, very different from the one shown. Thus M. Gassiot's splendid instrument at Kew consists of eleven prisms and three-feet telescopes, and, by substituting for the ordinary glass prism a hollow prism filled with the bisulphide of carbon, we get an enormous dispersive power; but it is so easily affected by changes in temperature as to be very difficult to use, and is of service only in very practised hands.

Mr. Browning, the maker of the instrument on the table, has, in order to insure accurately plane surfaces, constructed and exhibited, at the Bath and Bristol British Association Meeting, 1864, two instruments for measuring irregularities, by one of which he could detect, by direct reading, an irregularity of a twenty-thousandth of an inch, and, by estimation, a fifty-thousandth. By the other, irregularities of a millionth of an inch were discoverable.

The researches of Professor Hinrich proving that the distances between the lines of each separate group are multiples of the smallest distance in such group, and certain other laws in regard to the wave length, discovered by the same philosopher, would seem to warrant his conclusions, that the form, even of ultimate atoms, may, by this means, be arrived at. He says:—"The lines must be produced, by either the dimensions of the solid particles, or by the intervals between them, *i.e.*, their distances. The latter is impossible, for their lines remain the same under such different circumstances, as cannot but, to some extent, change the mutual distance of the particles. Hence the lines must be produced by the bulk of the particles or atoms themselves, and an exact knowledge of these laws and distances must lead us to a knowledge of the relative dimensions of the atoms, as to length, breadth, and thickness. Thus optics will give us the form and size, as chemistry has given us the weight of the atoms" It may even, according to some, lead us to an experimental demonstration of the existence of a primitive substance, the element of the elements. This subject formed the darling theory of the late Dr. Samuel Brown, of Edinburgh, who considered hydrogen to be *the* element.

Now, this short touching upon this subject is intended merely as a suggestive. I am quite aware of my inability to treat it as it deserves, even though I had access to the necessary authorities; but if an interest has been excited in any, which may lead to the prosecution of experiment in this branch of science, our time this evening will not have been mis spent.

Printed by G. Wight, "Guardian Office," Brisbane.

THE

ANNUAL REPORT

OF THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

1865.

WITH

THE PRESIDENT'S ADDRESS.

OFFICERS FOR 1865.

PATRON:
His Excellency Sir G. F. Bowen, K.C.M.G., &c.

PRESIDENT:
His Honor Chief Justice Cockle,

VICE-PRESIDENT:
Charles Coxen, Esq., M.L.A.

TREASURER:
Alexander Raff, Esq.

SECRETARY:
Rev. John Bliss.

AUDITORS:
Rev. R. Creyke, B.A. | E. Macdonnell, Esq.

COUNCIL:
S. Diggles, Esq. | H. C. Rawnsley, Esq.
Rev. James Matthews | Dr. Waugh
G. Wight, Esq.

BRISBANE:
PRINTED BY G. WIGHT, "GUARDIAN" OFFICE.

THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

ANNUAL MEETING HELD ON MONDAY, DECEMBER 4, 1865.

(From the *Queensland Guardian*, December 6, 1865.)

The annual meeting of the above society was held on Monday, December 4, in the Municipal Chambers, the President (Chief Justice Cockle), in the chair. The business of the evening commenced with the reading of the minutes by the Secretary, Rev. John Bliss. The minutes being confirmed, the Secretary proceeded to read as follows the annual report :—

ANNUAL REPORT, 1865.

" In reporting the proceedings of the Society during the past year, the Council have pleasure in stating that the number of members continues steadily to increase.

" Nine meetings have been held, at which five original papers have been read by different members, and also two communications from Mr. Wilson, of Adelaide, a corresponding member.

" It is with regret that the Council have to report that the meteorological observations have not been received, in continuation of the valuable collection already in the possession of the Society, and this loss is the more to be regretted in consequence of the somewhat unusual character of the season.

" The first supply of scientific periodicals has been received, and are now available for the use of members. The succeeding numbers will be received regularly by post.

" The first shipment of books ordered by the Society is on board the ship Clan Alpine, which is daily expected to arrive, and the remainder will follow at an early date.

" The Treasurer's statement shows a balance of £109 3s. 8d. to the credit of the Society."

Chief Justice COCKLE, F.R.S., then delivered the following address :—

In the discharge of the duties of the office with which you have honored me, I have this evening to deliver the anniversary address prescribed by the rules of the Society, and to thank you for the confidence which you have reposed in me. To the report of the council I have nothing to add. We may now, I think, venture to congratulate ourselves on the stability of our Society, and to indulge hopes that each succeeding year will bring us an accession of members, and, with it, an increase of activity and an enlargement of our sphere of usefulness. We must not allow ourselves to doubt but that the noble examples set us by New South Wales and Victoria will be followed here, and that the same success which has attended the scientific societies formed in those colonies, will await this, our kindred institution, in Queensland. We gladly welcome all who are willing to work with us, and our sole test of brotherhood is a desire to co-operate in the communication and diffusion of information. No more convenient record than our proceedings offer can be found for those observations which, in a new country, daily present themselves to such as have the inclination or the ability to seek for them. And we may confidently point to the pages of our transactions as containing

rare illustrations of what may be done in the way of original research, even by such of us as are occupied in the pursuits of active life. Australia affords fields of investigation and discovery, such as those the most favorably situated in older countries would strive after in vain. It must not, however, be supposed that we wish to devote an exclusive attention to those sciences which, like natural history, have interest enough in themselves to ensure them a favorable hearing from all. We shall lend a ready ear to those who are willing to make us the auditors of scientific communications of any kind, and if we cannot attain to universal knowledge, we shall at least, I hope, exhibit a universal scientific toleration. The papers read before the Society during the present year have been as follows :—

Mr. Le Gould, "On the Coniferous Trees of Queensland."

Mr. Rawnsley, "On the Habits of the Satin Bird."

The President, "On Linear Differential Equations."

Mr. Diggles, "On the Microscopic Scales of Insects."

Dr. Waugh, "On Spectrum Analysis."

The list is not a long one ; but I hope that the Society has no reason to be other than satisfied with the papers thus published with its approval. In that of Dr. Waugh, we have a valuable account of the spectrum discoveries and their results, and a comprehensive view of the subject, which not only interests him, who, like me, looks at it with the eye of a mere amateur, but which must also interest all who delight in observing the correlations of science. In perusing Dr. Waugh's paper, we see how optical research has contributed to chemical discovery, and how chemistry promises to repay the debt by disclosing to natural philosophy the forms and dimensions of the ultimate particles of matter. How marvellous that optics should thus be brought into strict relation to toxicology, and that the prismatic observations of Fraunhofer should thus be made subservient to the purposes of police. But this is only one instance of that, often unexpected, relation of one science to another which meets us as we turn over each page of the volume of philosophy. From this relation each derives new applications and a new value; and we, in common with all, should hail with delight results which place upon the same platform those who would otherwise be working isolatedly and on solitary fields. Here, then, is a new and common ground on which the chemist and the physicist can meet in the same way that the physician, the lawyer, and the chemist, meet on the common ground of medical jurisprudence. And there is a common ground on which, strange as it may seem, the physiologist and the mathematician may meet. In July last Mr. Benjamin Gompertz, once actuary to the Alliance Life Office, died in his eighty-seventh year. Apart from other titles to distinction as a mathematician, to Gompertz is ascribed the discovery of what has been aptly termed "a mathematical law of human mortality, which embodies what may be called a physiological principle. It bears the following expression—that vitality, or the power to oppose death, loses equal proportions in equal times." Speculations, mere speculations, will say some. Be it so: but it is upon the accuracy of such speculations that the prosperity of insurance offices depends: it is upon the accuracy of the astronomer and the geometer that the navigator relies ; and it is from the results of some "visionary speculator" that the practical man often derives the rules which he applies without understanding the reasons on which they are founded. I am not of those who would claim for the theoretical an invidious place of superiority over the practical man. But I think that the claims of the former should be as warmly supported by us, as a body, as those of the latter, and the generous mind will always refrain from drawing invidious comparisons between them. It is, moreover, a mistake to suppose that, by narrowing our view, we in all cases take the best observation even of that narrow view which we seek to master. The ablest men on particular subjects have often a knowledge, by no means superficial, of subjects not having any obvious connection with that on which their fame is founded. A conspicuous example of this is seen in one whose recent death will be deeply deplored by many. In September last, Sir William Rowan Hamilton, Professor of Astronomy in the University of Dublin, and Astronomer Royal of Ireland, died at the Dunsink Observatory. Born in Dublin in 1805, and educated at Trinity College, Dublin, he was appointed, in 1827, Astronomer Royal of Ireland and Professor of Astronomy, which post, attained by him at the age of about two-and-twenty, he filled down to the time of his decease. To many persons he was, perhaps, better known by his researches on physical subjects, than by his theory of "Quaternions ;" but the latter is one of surpassing interest, simplicity, novelty, originality, importance, and extent, which I mention now because, before I conclude, I shall have occasion to allude to that theory in connection with the progress of mathematical science in Australia. Now, this man, whose renown was European, who on his own field of research was unapproachable, and who, I believe, possessed many attainments which some would class rather with accomplishments than acquirements, found leisure to examine the metaphysical speculations of Kant, and in his paper "On Algebra considered as the Science of Pure Time," has, while leaving a record of genius, left also an illustration of the light which the study of one science may throw on another apparently but

remotely connected with it. And here, in connection with science in Australia, I may mention that I have received from Mr. Martin Gardiner of Sydney, a printed paper (reprinted from the transactions of the Philosophical Society of New South Wales), in which he demonstrates, by processes of his own, certain theorems which Sir W. Rowan Hamilton deduced many years ago by means of quaternions. It happens singularly enough that I directed the attention of Professor Davies, of Woolwich, to the theorems in question, and that they were transcribed by my direction for insertion in a paper of Davies, at a time when the theorems, to which Mr. Gardiner seems to have successfully applied himself, were not only undemonstrated save by the quaternion calculus, but were regarded by Davies as remarkable extensions of others, to improved demonstrations of which he was then calling the attention of geometers. And while touching upon Australian science, I cannot avoid referring to another instance of correlation, (or rather perhaps, of a successful application of the doctrine of final causes) that occurs in a paper, which, as a production of one of us, will have a lively interest here. Some time ago Mr. Diggles, at my request, drew up a detailed statement of an observation which he had made, and which I had intended to transmit to England for publication. I have since thought that I could not make a better use of it than by appending it to this address. It is as follows:—

"When engaged a few years ago, capturing insects in a small scrub near Brisbane, my attention was drawn to an interesting circumstance—that of a butterfly (Euplæ) evidently desirous of depositing its eggs on a particular tree. That such was the intention of the insect I could not doubt, as nothing but the strongest instincts of nature would have caused it to persevere in its attempts to alight on the particular tree in question, in spite of various attempts to capture it. The insect is a rather common species, and I had formerly reared specimens from leaves found on the Oleander. This plant being of recent introduction, the thought occurred that the plant which seemed so much to attract the insect's attention, might possibly belong to the same natural order or family, and so it turned out, for though the flower was very small, it had all the character of an Oleander; but the seed vessels which I was fortunate to find at the same time, placed the matter beyond doubt. I have found another plant (a creeper) which must belong to the Oleanders, as the seed vessels were almost identical in form. The flower I did not see. The insect in question was plentiful in the neighbourhood.

"Another fact of equal interest I am able to supply:"—

"The two Papilias, (P. Erectheus) and (P. Anactus) now found feeding on our orange and lemon trees, subsisted doubtless formerly on the native lime of the scrubs. I recently obtained about twenty-five chrysalides of the latter insect from a small bush."

With this paper of Mr. Diggles, I must close remarks already, I fear, too extended, and conclude by again wishing prosperity to the society.

The meeting then procceded to elect the officers and council for the ensuing year, as follows:—Mr. Chief Justice Cockle, President; C. Coxen, Esq., M.L.A., Vice-President; A. Raff, Esq., Treasurer; Auditors—Rev. R. Creyke and E. M'Donell, Esq. Rev. John Bliss, Secretary. Members of Council—Messrs. Diggles, Matthews, Rawnsley, Waugh, and Wight.

QUEENSLAND

PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, March 30, 1866.)

The following paper was read at the last meeting of the Philosophical Society, by Mr. W. P. Townson :—

When I gave in the name or subject of my paper to the Secretary, I had not then thought how boundless it was. Its vastness was almost sufficient to appal one, but it carried along with it the comforting conviction that it would be a safe subject to fall back upon, if required to give a paper at any future meeting.

The neglected vegetable product that I have chosen, is the Banana, or Plantain. I use the word neglected as applicable to Queensland in almost every point of view; it is planted and then neglected, its fruit is cut off and the stem and leaves are either tossed into the river or else piled np on some rubbish heap to add to the disagreeable odours that greet our senses —from beginning to end it is neglected. I have used the words Banana or Plantain, as the difference between these plants is so slight that it is most probable that there was originally but one stock from which they have, by cultivation and change of locality, been derived. It has never been determined with exactness, whether the Plantain or Banana (which ver be the parent stock) exists anywhere at present, or has been known to exist, as a perfect plant —*i.e.*, bearing fertile seeds; or whether it has always existed in the imperfect state, *i.e.*, incapable of being procreated by seeds.

Linnæus conjectures that the "Bihai" (*Heliconia humilis*), a native of Caraccas, which produces fertile seeds, is the stock plant of the Plantain or Banana, but the absence of any description of a wild seed-bearing Banana, renders it highly probable that the cultivated species are hybrids produced long ago. The Banana from time immemorial has been the food of the philosophers and sages of the East, who have used it either in its ripe state, or as a farinaceous vegetable, roasted or boiled. It is remarkable that the Banana should be indigenous, or at least cultivated for ages both in the old and new world. Numerous South American travellers describe some one of these plants as being indigenous articles of food among the natives, thus showing (if the Banana and its varities be hybrids) a communication between the tropics of America, Asia, and Africa, long before the time of Columbus. The older writers on Guiana, consider the Banana or Plantain indigenous. Sir R. Schomburgk, during his travels, found a large species of Edible Plantain far in the interior. In the northern parts of our colony, later explorers have found large tracts of Bananas, which, from an estimation of the character of the natives as evinced at present, must be indigenous. These tracts during the fruit-bearing season are resorted to by the natives, and seem to be the only support they require for the time.

The several varieties of the edible Plantain or Banana found in the West Indies, are reducible to two classes (*Musa Paradisiaca* and *Musa Sapientum*), or as named by them, the Plantain and Banana.

In Queensland, the term Banana is indiscriminately applied to both classes, though doubtless we have not the largest size described by some of our West Indian authorities. Lindley enumerates 10 species of *Musa*, which range in height from 4 to 30 feet; the most valuable seem to be the most stunted. In the strait's settlements of the East, the Royal Plantain yields fruit in eight months, there is one that bears in a year; beside these there are others held in high estimation, viz., the Milk Plantain, the Downy Plantain, and the Golden Plantain or Banana. The Malays assert that they can produce new varieties, by planting three shoots of different sorts together, and by cutting the shoots down to the ground three successive times when they have reached the height of nine or ten inches. In Syria the Banana (according to Humbolt), ceases to yield fruit at the height of 3000 feet, where the mean annual temperature is 68 degrees; the highest range of the Banana seems to be about 4,600 feet.

The tribe *Musaceo* is endogenous; the stem possesses no traces of medullary rays, but consists of a cylindrical mass of cellular tissue at the root. This mass, towards the top becomes separated, and near its centre is prolonged, and becomes the back-bones or frames of the large umbrageous leaves. The whole of the species, and varieties of the tribe are *polygamous monocious* plants, bearing male, female, and hermaphrodite flowers within the same spathe—all being imperfect, and unproductive of seed. Any individual may, from excess of culture, moisture, &c., be entirely incapable of flowering. The common Banana (of Hockings' Manual "*Musa Maculata*,") in Jamaica is called the Tiger Plantain. Whilst on the botanical part of my subject, I may mention that each authority I have consulted holds opinions different from the rest. Some differ so widely that I almost come to the conclusion that they speak not from personal observation, but from hear-say. Carpenter describes the fruit of the Plantain, *i.e.*, every variety of Plantain, as insipid; whilst our Queensland authority (page 62), states that the "*Musa Masculata*," or Tiger Plantain, when ripened on the tree, is very superior in flavor.

The vegetation of this tree is so rapid that, if a line of thread be drawn acros and on a level with the top of one of the leaves when it begins to expand, it will be seen in the course of an hour to have grown nearly an inch. There is hardly a cottage in the tropics which is not partly shaded by this plant, and it is successfully grown under other fruit trees, though it is independent of shelter; its succulent roots and dew attracting leaves render it useful in keeping the ground moist during the greatest heats. It is the most valuable of all fruits, since it will supply the place of grain in time of scarcity. To the negroes of the West Indies it is invaluable, and, like bread to the Europeans, is with them denominated the staff of life.

The greatest authority, and one quoted by almost every writer who has touched on this subject, is Humboldt, who states that a plot of ground, containing 30 or 40 plants, will yield in the course of the year upwards of 4,000 lbs. of nutritive substance. M'Culloch states that the same plot of ground, planted with wheat, would not produce more than 30 lbs., and not more than 90 lbs. of potatoes; hence the produce of the Banana is to that of wheat as 133 to 1, and to that of potatoes as 44 to 1. According to the same writer, the apathy of the inhabitants of the "Terras Calientes" of Mexico is mainly to be ascribed to the abundance of food derived from the banana, which grows almost without labor.

In Queensland we allow the fruit to grow almost ripe; but in the West Indies it is either cooked, *i.e.* boiled, roasted, or fryed when green, or else cut into slices, dried, and pounded into a kind of flour, whilst still in a green state; and the creoles call it in this state, "Conquin Tay." It has a fragrant odor, produced by drying, and is largely employed as the food of infants, children, or invalids. In Mexico the fruit, when dried, is called "Plantado Pasado," and is a considerable article of internal commerce.

Besides being an article of food for man, there are other uses to which the plant is put. The foliage affords food and bedding, and is used for thatch, making paper, and basket making. From its petioles or fruit stems is obtained a fine and durable thread;—the tops of the plants are eaten as a delicate vegetable, and the fermented juice of the trunk produces an agreeable wine.

I have briefly enumerated the various ways of using the fruit, as it is not entirely neglected, but I wish to draw more attention to that which is entirely neglected, viz:—the trunk and leaves. In a country like ours, where occasional droughts cause nearly all vegetation to shrivel, and become useless; where the failure of green crops is not unfrequent; it becomes us well to consider and remedy any want of such necessary food. We or our families are the ones who suffer the most, as in such cases the poverty of the milk frequently contaminated with disease, is surely attended with disastrous effects, if not to ourselves, to our little ones, who are more dependent on its supply, and whose health is more or less affected by any deterioration in quality.

In all countries but our own, the succulent stem and leaves are an invaluable food for horses, cattle, and swine; the trunk is so soft as to be cut with a knife; in the West Indies

it is cut up into slices by large turnip cutters, and eagerly devoured by all kinds of cattle. If our stupid prejudices and obstinacy did not stand in the way, the instinct of not only the poor starving cattle, but even the well fed would show us what folly it is to cast out on the dunghill so valuable and never failing an article of fodder. If the fruit be produced in such abundance, much more will the stem supply our cattle with a constant and almost continual supply of food. The same extent of ground, which, in Europe, is calculated to supply 30 lbs. of wheat; and, in the tropics, 4,000 lbs. of fruit, at a low calculation, will supply 20,000 lbs. of fodder, fresh, green, and succulent; or, one stock will annually supply 500 lbs. of green fodder. For the sake of example—say, 1 acre of bananas planted 20 feet apart; that will be 100 stools, or 50,000 lbs., nearly 23½ tons of fodder. Take the distance usually allowed here—4 yards apart—that will give 302 stools, or 151,000 lbs., nearly 67½ tons of fodder. Taking the fruit and fodder together, an acre of 100 stools will produce 10,000 lbs. of fruit and 50,000 lbs. of fodder, whilst an acre of 302 stools will produce 30,200 lbs. of fruit and 151,000 lbs. of fodder. I do not wish you to take my statements on trust; but I wish you, at your first opportunity. to count the number of stems in the first well-cultivated stool you can examine; and then I feel convinced that the calculation you will make will exceed even the highly improbable and astounding result of mine. I will, at some future meeting, resume the subject, and give a full account of its fibre producing qualities.

The authorities to whom I am mainly indebted for facts and some figures are Humboldt, Schomburgk, Carpenter, M'Culloch, Simmonds, Henslow, Lindley, &c.

ERRATA.

PAGE 2, COLUMN 1, LINE 29—*For* "Musaceo," *read* "Musaceæ."
" " " 37—*For* "Monocious," *read* "Monœcious."
" " " 57—*For* "acros," *read* "across."

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THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, May 9, 1866.)

At the meeting of Monday, April 30, 1866, the President, Chief-Justice COCKLE, F.R.S., read the following paper—"On the Fundamental Principles of Hydrostatics."

1. In many, perhaps all, of the natural sciences, the starting points have been certain general or primary assumptions which, determining the direction of research, have in their turn been modified or extended in conformity with the results of subsequent experience. Thus, in astronomy, the original notion, that the bodies of the solar system moved in circular orbits, gave way, after modifications, to a theory of elliptic motion, whose formulæ are still the basis of that theory of perturbation to which the doctrines of gravitation have given rise. So, in hydrostatics, we commence by investigating the hypothetical properties of an ideal fluid or liquid to which, possibly, no actual fluid or liquid has any closer resemblance than the orbit of a planet has to a circle. Water, for example, would probably in the first instance be regarded as a perfectly inelastic and incompressible fluid, and yet we know it is slightly compressible. Again, if we define a fluid as a body whereof the particles are moveable, one amongst the others, without friction, and with the slightest assignable force, water does not conform strictly to the definition, for experiment indicates that there is, between the particles of water in motion, a mutual friction sufficient to develope an appreciable quantity of heat. Further, if we regard a fluid as a substance divisible in any direction whatever, by the slightest assignable force, water does not conform strictly with our conception of a fluid, for we see particles or bodies borne on without penetrating it by an act of floatation. As for instance, needles, and the insects which are often seen standing, walking, or skimming on its surface. And yet it is on the supposed properties of an ideal fluid that we should have to base investigations respecting the equilibrium or motion either of water, which nearly resembles a perfectly inelastic incompressible fluid, or of oils, which attain a level, though not so speedily as water, or of tar or bitumen, or honey, or other viscous bodies more or less resembling a perfect fluid in their properties. And the results of hydrodynamics would, in many instances, and with more or less modification, be applicable to the motion of streams of mud or lava, or, to some extent, of glaciers which, since ice is plastic under pressure, though not under tension, probably exhibit under certain circumstances a plasticity which may be compared to that of soft wax. The modifications of the pure theory will, of course, depend upon the time required by the viscid body for the manifestation of its fluid properties, such as the finding its level and the transmission of pressure; or they may depend upon the presence of solid matter in the imperfect fluid, as in mud. But, whatever be the application of the fundamental principles of hydrostatics, and whatever be the modifications which practice may require to be made in theory, it is important that the properties of the ideal perfect fluid should be thoroughly investigated. Any misconception of principles will throw a cloud over the whole subject, and the incautious admission of an imperfectly proved proposition, or of an arbitrary definition, may affect our conception of the entire science. The object of this paper is to show that certain extraordinary conclusions, arrived at within the last thirty years, and supposed to be demonstrated, can only be sustained by our attributing to the ideal fluid a property in no degree essential to the mathematical theory of fluids, and not as yet shown to be possessed by any fluid which we meet with in nature.

2. Many years ago there was reprinted in "Taylor's Scientific Memoirs," a Memoir by Ostrogradsky, entitled, *Sur un cas singulier de l'équilibre des fluides incompressibles*, published, in the year 1838, in the memoirs of the Imperial Academy of Sciences of Saint Petersburgh. From this memoir Mr. Walton (Quarterly Journal of Mathematics, vol. V, p. 209) has extracted a passage in which a condition of fluid equilibrium is described, which tends to show that the ordinary theory of hydrostatics is not universally true. I translate the passage freely as follows:—

"Suppose," says Ostrogradsky, "that the liquid forms a spherical layer of any thickness, and of which each particle is attracted towards the centre by a force proportional to a function of the distance of the particle from the centre; equilibrium will necessarily exist. For the particles situate at the same distances from the centre of attraction cannot move unless all move in the same manner. If one of the particles approaches the centre all must approach

it, and approach it, too, to the same extent. But this they cannot do in such manner as that all the particles situate on any one and the same spherical surface described round the centre of attraction, shsll take the same movement; for, if they could, a diminution of of the volume of the liquid would be the result. Thus, the liquid will remain equilibrium. But it is evident that the force which attracts each particle situate at the inner surface of the layer tends to urge the particle, not towards the liquid mass, but away from it." Ostrogradsky then calculates the pressure at the inner surface, and says, "This pressure is certainly different from zero, which again is contrary to what has been heretofore admitted. Here, then, we have a singular case of equilibribrium which has escaped the known theory of liquids, and which authorises us in concluding that that theory has not yet attained a befitting development."

3. Mr. Walton discusses this singular case of fluid equilibrium not only because it is in itself curious as a speculative question, but also because a right interpretation of such equilibrium—although, as being unstable, only theoretically possible—may tend to awaken criticism on the fundamental principles of practical hydrostatics. Mr. Walton then considers the question from Ostrogradsky's point of view, observes that the pressure at the internal surface need not exceed an infinitesimal quantity, and that the problem of internal pressures in Ostrogradaky's shell is, in fact, indeterminate; and concludes that the theoretic demonstration of the equality of fluid pressure in all directions at any point is unsound in regard to unstable equilibrium, and that it is theoretically possible to have a complete sphere of fluid in equilibrium in which "the principle of the equality of fluid pressure at any point in all directions" is not true. In this case Mr. Walton conceives that the fluid would be stable in regard to the geometry of the fluid, and unstable in regard to the relative mechanical actions of its elements.

4. Now this supposed new hydrostatical paradox not only explicitly assumes the absolute incompressibilty, but it also, as I shall show, tacitly implies the absolute continuity of the liquid. The explicit assumption is unobjectionable enough, for even if in nature there should exist no perfectly incompressible fluid, still the theoretical properties of such a fluid would, as an approximation at all events, guide us to the properties of a partially compressible fluid. And, more, the new paradox might have a place in the discussion of the latter fluid, allowance being made for a contraction of the inner surface before equilibrium is established. But the tacit assumption seems to me to be open to grave objection. It is superfluous. In order to establish the science of hydrostatics, it is unnecessary to frame any hypothesis whatever as to the constitution of fluids, and, whether they be supposed to be absolutely continuous bodies or to consist of discrete solid particles, the conclusions of the science are alike valid. We sufficiently characterize a fluid when we say that its parts are freely moveable amongst each other without friction and on the application of the slightest force. The fundamental principle of hydrostatics, viz., the equality of fluid pressure at any point of a fluid in all directions, whether proved theoretically or confirmed experimentally, is true of a body so constituted. In fact, as we pass from the consideration of such bodies as water to that of oils and viscid matters, which require time to find their level, and, thence, to the case of powder, sand, or stones, which when heaped up find a sort of level though not a horizontal one, we see that the transition from ordinary mechanics to hydrostatics is not quite so abrupt as might be imagined. To make this plainer, conceive three billiard balls placed on a horizontal table in contact with each other, and a fourth to be placed on the top of and in contact with the other three. If we suppose the balls as well as the table to be perfectly smooth, and no friction or cohesion to act either between the balls themselves or between the balls and the table, the uppermost ball will descend, pushing the others apart and resting in the centre of the equilateral triangle, at the respective angles of which the other three will be found until they meet the edge of the table. The same thing would occur with any number of perfectly smooth balls placed anyhow on a perfectly smooth table. Were the table large enough, each ball would ultimately descend to the table; and so the system of balls would find a level, the counterpart of the hydrostatic level. The final state of a system of smooth balls placed anyhow on a smooth horizontal confined space would be determined by the principle that the centre of gravity of the system would be as low as possible.

5. At first sight the consideration of this case of perfectly smooth hard balls upon a perfectly smooth hard horizontal table seems to give a plausibility to Ostrogradsky's paradox. If any number of such balls be placed in a straight line and in contact, then, whatever be the attractive force exerted by the balls, or whatever equal external pressures be applied to the outermost balls, in the direction of the line joining their centres and towards the interior of the system, equilibrium, though unstable, will result. So if we place on the table a perfectly smooth and hard circular cylinder, with its axis vertical, the relative sizes of the cylinder and the balls may be so adjusted as to render it possible to encircle the cylinder with a ring of balls, all of the same size, each of which shall be in contact with two contiguous balls, with the cylinder and with the table. This adjustment is conceivable, because we know that theoretically—that is to say without a geo-

metrical contradiction—we may postulate the description of an equilateral and equiangular polygon of any number of sides whatever. The ring being thus formed, let a second circular cylinder be placed vertically on the table so as to envelope the ring of balls externally, and, further, suppose that the second cylinder is tightly pressed, by its own elasticity or otherwise, round and against the ring of balls. Next, remove the inner cylinder. Equilibrium will still subsist and the ring of balls will remain undisturbed, for the resulting pressures of the tightened envelope will act in the direction of a point in the axis of the cylinder at a distance from the table equal to the radius of the balls, and will be counteracted by the mutual pressures of the balls, which, as a moment's reflection will show, tend outwardly, as those of the envelope tend inwardly, to the ring. Or, to use an argument like Ostrogradsky's, the pressure of the envelope tends to force the balls towards the centre of the ring, as we may call the point just spoken of: but, the balls being equal and similar and similarly situated, there is no sufficient reason why any one rather than another should approach the centre, and, inasmuch as the balls, supposed to be hard and incompressible, cannot all approach it together, no motion of any ball towards the centre can ensue. And if we substitute for the tightened envelope its physical equivalent, an attractive force tending towards the centre of the ring, we may admit Ostrogradsky's result in the case of a system of spherical particles, ranged in a circular ring round a centre of attraction; for the same argument will show that no ball can, so to say, be squeezed out of the ring, and forced to move away from the centre.

6. But, by an argument which I shall endeavor to illustrate, he calls upon us, implicitly at least, to go further. Conceive a smooth homogeneous perfect sphere, of the size of the earth, endued with attraction like that of the earth, but destitute of any motion either of translation or rotation, uninfluenced by the attraction of any of the heavenly bodies and covered by a film, layer or ocean of a homogeneous incompressible liquid, say water, supposed, for the present purpose, to be absolutely incompressible, and of the same density at all temperatures. Suppose, further, that there is no cohesion between the liquid and the sphere, and that by a decrease of temperature or by any other means the spherical earth contracts—according to Ostrogradsky the fluid, film, layer, or ocean will remain motionless, a liquid vault interposed between the infinite space external to the fluid, and the void and finite expanse occasioned by the contraction of the earth. The suppositions just made are, in substance, the same as the conditions of Ostrogradsky; for we know that, according to the law of gravitation, the resultant attraction of a system of concentric homogeneous spherical layers or shells, is the same as if the matter of all the shells were to be concentrated at their common centre. His argument is substantially the same as that which I have employed above; the particles of the liquid being supposed to be equal, similar, and similarly situated, the symmetry of the arrangement round the centre shows that, for want of sufficient reason in that behalf, no one particle can approach the centre unless all the particles situate on the same spherical surface do so simultaneously. But this they cannot do, since the liquid is supposed to be incompressible. Nor, by the like principle of sufficient reason, can any one of the particles on the same spherical surface be squeezed or pressed outwards, that is to say, in a direction away from the centre. Hence, the inference that the liquid vault will remain in equilibrium.

7. This inference seems to me to be erroneous, unless we impress an arbitrary constitution on the fluid, and have recourse to the unnecessary hypothesis that a fluid is absolutely continuous. Conceive the contraction to be continued until all the matter of the supposed spherical earth is concentrated at its centre, and we formally, as well as substantially, have the case discussed by Ostrogradsky. About that centre, describe geometrically a sphere passing through one of the points of contact of the particles situate on the inner surface of the liquid vault. Then, from the symmetry of the arrangement, we know that the geometrical sphere will pass through all the points of contact of all the particles situated on that surface, and all the points of contact of any one particle will be in one plane. In a plane, through the points of contact, draw geometrical tangents at all the points of contact of any one particle with all the adjacent particles. Then the symmetry of the supposed arrangement shows that the closed figure so formed will be a regular (equilateral and equiangular) polygon. And that symmetry further indicates that each particle will afford the construction of a similar polygon, that all the polygons so formed are equal, and that each side of each polygon is common to two adjacent particles, and forms the edge of a regular polyhedron. But, we know that there are only five regular solids or polyhedra—namely, the regular pyramid (or tetrahedron), bounded by four equal and equilateral triangles, the cube (or hexahedron) by six squares; the octahedron by eight equal and equilateral triangles; the dodecahedron by twelve equal and equilateral pentagons; and the icoshedron by twelve equal and equilateral triangles. Consequently, however we adjust the magnitude of the spherical balls or particles in reference to that of the geometrical sphere, if we require a system of balls such that each ball shall be capable of being placed in contact with the adjacent balls while each shall be equidistant from the centre of the geo-

metrical sphere, we are restricted to systems of four, six, eight, twelve, and twenty balls, each touching the others of the same system as follows: viz:—Three others in the system of four, four others in the system of six, three others in that of eight, five others in that of twelve, and three others in that of twenty. A case of fluid equilibrium which can only occur where the particles of the fluid do not exceed twenty in number, can scarcely be held to affect the fundamental principle of hydrostatics. And the fact that, while the number of regular polygons is unlimited, that of the regular polyhedra is limited destroys (except in the particular instances just adverted to) the analogy between a line or circle of particles in equilibrium and a sphere of like particles in equilibrium, and prevents it from being urged in support of the new hydrostatical paradox. I do not, at present, call to mind any investigations in which a perfect continuity of the fluid is assumed, unless, probably, in some of those of Professor Challis of Cambridge. But, even if I am right in thinking that he has assumed it, all the ends that he had in view would probably be equally well served by changing the assumption to that of particles or distances infinitesimally small in comparison with the particles whose motion is discussed or the mutual distances of the latter particles. At all events, a hypothesis assumed for a special purpose ought not to influence the present discussion, unless it explains phenomena to be explained in no other way.

8. The objection here taken cannot be answered by any assumption short of that of the absolute continuity of the flood. It is not answered by an hypothesis that a fluid consists of infinitesimally small discrete particles. The difficulty arising upon the geometry of the question holds for any actual magnitude of the discrete particles, however small, and to assume the infinite physical divisibility of the fluid, is to assume its absolute continuity. Nor is there anything in the researches of Poinsot and Cauchy (I speak from the notice of their investigations by Mr. Cayley in the Philosophical Magazine, ser. iv, vol. xvii, pp. 123,209), as it seems to me, to rebut it. Even if the Poinsot's four new regular poly hedra (in an extended signification of the term) could be employed in the above investigation in the same way as the regular polyhedrons of ordinary geometry, the conclusion would remain that Ostrogradsky's theorem can only be true for a limited number of discrete particles. Nor can any objection be successfully taken on the ground that I have assumed that the particles are spherical. It is sufficient for me to have shown that on that supposition Ostrogradsky's theorem does not hold, and, speaking of those who have preceded me in the discussion with the deference due to recognized learning and eminent scientific position, I say that is incumbent on him who controverts, not on him who defends, the received principles of hydrostatics, to show under what other circumstances the theorem can obtain.

9. The researches of Ostrogradsky and of Mr. Walton are, as might be anticipated, mathematically speaking, of high interest. The only exception which I take is that the hypothesis of continuity which they tacitly involve is unnecessary. I might go further, and say that it is perhaps more contradictory to than consonant with current notions, which appear rather to regard all matter as consisting of discrete molecules or particles than as perfectly continuous. Without going into any lengthened inquiry on this point I would cite a paper of Dr. Waugh, read to this society, in which he speaks of "ultimate atoms." Whether the constitution of fluids be atomic or not, a general theory of hydrostatics ought alike to embrace them. If it be atomic, then such a state of things as that contemplated in article 6 of this paper could by no possibility arise. Each particle at the under surface of the ocean could not be similarly situated in respect to all the other particles on that surface, and, from this lack of symmetery, however sudden, extensive, or uniform might be the contraction of the earth, the superincumbent waters would rush down upon it, and, after reaching it, be not strictly in equilibrium, but subject to the internal currents to which the necessarily unsymmetrical distribution of the atoms would give rise. The nearest approach that could be made to the state of things pictured by Ostrogradsky is that while the mass of waters rushed towards the centre, there might possibly be left of each spherical layer two rings of atoms, intersecting at right angles, and lying along great circles of the spherical surface. I say possibly, because it is just conceivable that the atoms of the whole mass might be symmetrically distributed in regard to such pairs of rings. But it is not worth while now to discuss this phantom of the original theorem.

10. I conclude therefore that the fundamental principle of hydrostatics, viz., the equality of fluid pressure at any point of a fluid in all directions, is unshaken, save in a certain case of the unstable equilibrium of a perfectly continuous liquid; and that, in as much as the existence of such a liquid is hypothetical only, the exception to the universality of the fundamental principles of practical hydrostatics is likewise hypothetical only, and I also conclude that, if a fluid consist of discrete particles, then an equilibrium, stable or unstable, in which the recognized laws of fluid pressure do not hold, is not even theoretically possible.

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THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, June 2, 1866.)

THE KOMMILLAROY TRIBE.

At the meeting of the Philosophical Society, held on Monday evening last, Mr. CHARLES COXEN read the following paper :—

"A paper on some of the laws and customs of that section of Australian aborigines, known as Kommillaroy."

So very little being known of the customs regulating the general economy of the several tribes of Australian aborigines, and believing that any information on this subject will be of some interest and value not only to this Society, but to the colonists generally, I have been induced to bring to your notice such scraps of information concerning the usuages of the Kommilaroy tribes, gathered by me during an experience of some twelve years of my earlier life. I must, in excuse, for what to myself appears the meagreness of such information, beg to state that when the opportunity occurred for acquiring much greater knowledge on this subject, than I now possess, I neglected it, as at that time I had not the most remote idea that at some future period, I should be desirous of committing the same to paper. In judging of the aboriginal habits and manners, we must be careful that we do not suffer our minds to be influenced by the semi-civilised creatures we see about our towns and settled districts, or we shall lose altogether the characteristics of the savage in his normal condition. In the first they are in most cases drunken, fawning, idle, and treacherous; indeed, the contact with civilisation having afforded much opportunity for gratifying evil propensities, without corresponding benefits, has left them so degraded, as, I fear, to be incapable of improvement. In the last, they possess all the attributes of savagedom, and when their passions are influenced by injury or avarice, they show a ferocity, vindictiveness, and treachery, equal to anything found in the historic annals of their more civilised brethren ; and, possessing but indistinct ideas of *meum* and *teum*, they thoroughly believe in the old motto of "Let him take who has the power, and let him keep who can ;" but with all these bad and dangerous qualities, I have found them possessed of much simplicity, and when treated with firmness (so necessary for the subjugation of all savages), tempered with uniform kindness and truthfulness, capable of being utilised to a considerable extent. In many cases, some of which are on record, they have shown a degree of honesty and attachment, together with other qualities that no civilised man need blush to own, with a sufficient capacity for much improvement, which, being dormant, only requires a proper method and system for vitalising into activity; but whilst being convinced of these capabilities, I am also aware of, and fully recognise, the almost insurmountable difficulties of carrying out any plan or system in the present condition of things that would permanently utilise or benefit the aborignal race.

The Kommilaroy tribes, at the advent of the white man in Australia, were amongst the most warlike of the native tribes; and, whilst speaking the same language and submitting to the same laws and customs, were divided into sections, according to the different localities which extended over a very large tract of country, comprising the heads of the Hunter, Goulbourn, and north branch of Hawkesbury Rivers, Liverpool Plains, Mookai and Lower Namoi Rivers. Indeed, the Wellington Valley tribes appear to be a branch of the Kommilaroys, as their customs, superstitions, and primary names, with some trifling exceptions, are the same. Before entering on the principles of their nomenclature, which forms a leading feature in this paper, I will call your attention to the fact that each member of the tribe possesses three names, which may be described as primary, family, and surname or *soubriquet*. The whole of the Kommilaroy tribes possess but four primary names among them, two of which names form one division,

and the remaining two the other. Thus the tribes are divided into distinct sections; and, for the sake of better elucidating these principles of the tribes, I will hereafter call them primary divisions.

The primary names of one division are Combo and Hippi, with the feminine of Booda and Hippithaa. The primary names of the other division are Coppe and Murre, with the feminine of Coppethaa and Maathaa. These names are contracted from the maternal side, and are those of the grandmother, and are in no way guided by paternity. Thus Booda's children being Hippi or Hippithaa, according to the sex; and Hippithaa's children being either Combo or Booda, each succeeding generation taking the name of the grandmothers on the maternal side. This rule applies in like manner to the other primary division. I may say, *en passant*, that the knowledge of this rule has oftentimes afforded me considerable amusement in observing the surprise of a black man, when on learning his name I have mentioned to him his mother's name, so as to lead him to suppose I was acquainted with her; indeed, in some cases this knowledge of their names has done me good service, it having induced assistance and good feeling on the part of the man addressed that would otherwise probably have been withheld.

The possession of these primary names in no way represents affinity of blood; and you frequently find those bearing the same primary names bound in Hymen's fetters; consequently, it is generally supposed that there are no laws observed by the aborigines, which in any degree resemble the laws of more advanced nations for the prevention of too close intercourse, and that they marry and are given in marriage in a most promiscuous manner. That this is not so, I can most unhesitatingly affirm; and I am convinced that this erroneous impression has arisen from an imperfect knowledge of their nomenclature, as will, I think, be seen by attention to the system of obtaining the second or family names. These names represent many subdivisions of each primary division, and each subdivision bears its own distinctive name, and is the name of some bird, quadruped, or fish; and this name becomes the second or family name of each individual of such subdivision or family. This name, like the primary name, is also inherited from the mother, and is held by the law of the tribe to be a sign and token of relationship between all who bear it; and for any such (even should they be strangers to each other) to marry would be contrary to their laws. Thus, "Combo Mourri"—Anglice "Combo, brown snake"—may not marry "Booda, brown snake," although he may never have heard of her individuality previously. But as the primary division to which Combo belongs is divided into a score or more families, he is not prohibited from taking to wife Booda, of one of these.

This rule applies to the whole of the divisions of the tribe. Hence the error I have alluded to; for it must be observed that, in all our communication with the aborigines they are only known to us by their primary names—Combo Hippi, Coppe or Murre, as the case may be. The subdivisional or family name being unknown, and is as a sealed book to the white man. I have no hesitation in asserting that the prohibitory laws extend further than herein described, and I regret not having made myself better acquainted with the deeper subtleties of their matrimonial laws. I have also reason to believe that laws of a similar character are in force among the aborigines of the southern and northern coasts.

Before proceeding to the origin of the third name possessed by each member of the tribe, I will call to your attention that this law of relationship here alluded to has often led to much misconception on the part of the colonist, as to the aboriginals' idea of brotherhood, and I have often heard it said, "Blackfellows are all brothers when it suits them; for I knew one claimed as a brother by blacks who could never have known of his existence before." Such expressions are commonly uttered; but, if those who utter them would intelligently investigate further, they would soon understand the seeming anomaly; and, being once possessed of the system of subdivisional names (which is the only key to relationship), the claim of brotherhood would be as clear as day.

I will now draw your attention to their characteristic or third name, which may, perhaps, more properly be termed a *soubriquet*, it being derived from some circumstance at the time of birth, or from some personal peculiarity, quality, deformity, or other local cause, thereby differing most materially from their primary and family names, these being arbitrary and part of a system. The knowledge of this third name is necessarily confined to the circle in which the individual moves, and it is by these names being used in their ordinary conversation that they avoid the great confusion that would arise were they confined to the comparatively few names to be found in their first and second divisions.

Having disposed of their nomenclature, I must be pardoned for again reverting to the laws regulating matrimonial arrangements, and must not be understood to say these laws are always carried out in their integrity; for instances have occurred, within my knowledge, where men possessing considerable influence in their tribe have set the law at defiance with impunity; but such cases are rare, and only permitted to exist rather from the weakness and want of power in the Executive than from a willing acquiescence. These regulations for the prevention of a too close admixture of blood, must certainly have been founded on some such principles as rule the civilized world of the present day, and to me they seem

typical of traditions handed down from some very remote period. This and other circumstances have sometimes led me to consider the possibility of the present race having once occupied, in some portion of the world, a more exalted position then the poor degraded savages we are so familiar with.

The opportunity of acquiring the information herein detailed commenced about the year 1835; and in those days the superstitions of the aborigines were to them as a religion, and a few of the men of the tribe possessed considerable influence, either for good or evil, over the rest of the community from their supposed communication with beings of the other world; and on great occasions one of these seers or wise men would retire from his camp and friends to some wild mountain fastness or dense scrub, for the purpose of receiving supernatural visitation and instruction. After fasting for several days, and when the consequent exhaustion from such treatment reached a certain stage, he passed into a dreamy state, and, like our sages of old, had a vision, and held imaginary converse with the spirits of air. On the passing away of this dream, or vision, he returned to his tribe, and communicated to them what the Great Spirit had instructed should be done as to their future action. As it was rarely one was found possessing sufficient moral courage and determination to stand the severe test of hunger and solitude, the few who succeeded were invested with considerable importance in all matters connected with the interests and ruling of that section of the tribe to which they belonged. I have no doubt that occasionally there were impostors among them who traded on the superstitions of the tribe; but I am convinced that the greater number of these seers were themselves believers in the truthfulness and value of the supposed revelation made to them in their dreams or visions.

Charms and incantation were not uncommon among them, and I have known an old man who was of some importance in his tribe, and who was staying at that time on my station, during a severe storm of thunder and lightning, come to the door of the building in which I was living, and there perform a series of violent exercises, at the same time muttering words that I could not catch the meaning of, but supposed them to be a charm to keep away the lightning. On afterwards questioning him he told me that such was the case, and that he had done me much service by his incantation. During times of sickness, they have many forms of charms and such like superstitions for the relief of the afflicted; and have great belief in what is known in Europe as the evil eye (the kako mati of the modern Greek, and fascinatio of the ancient Romans), believing that some evil disposed men of their tribe have the power by a look to produce sickness, and even death; and I have more than once been appealed to to break the charm by shooting the supposed evil gifted. In each of these cases the parties recovered without my having had recourse to such violent remedies, but the dread, nevertheless, remained with the sufferer. Many of their charms are performed by the Croggie or Doctor of the tribe, with small pieces of crystalised quartz, which they keep carefully concealed in small bags, and most serious offence would be given by anyone getting possession of and exposing them to the women and younger members of the community.

Their religion teaches them to believe that among the innumerable dwellers in upper air there is a superior spirit called by them Biamaa, who is supposed to possess wives, children, and dogs, all of which they have names for. He is looked up to as a good beneficent being and as a protecting power in contradistinction to the inferior spirits of air known by the name of "Wonda," which means shade of the departed, or in other words a "ghost." Many of these are held in great fear by the aborigines, they believing that much evil oftentimes occurs through their instrumentality, and it is with great difficulty they can be induced singly to travel at night; indeed, I remember once having seen a whole camp thrown into the most abject terror, through a report of some supernatural visitations during the evening. That they believe in a future state is conclusive, from the foregoing, but beyond that I have not been able to gain any information, and I am inclined to believe that they go but little further themselves.

Many of the colonists are impressed with the idea that the black man believes that when he dies he "jumps up white fellow." This misconception has I believe arisen from the fact that the name given to the white man is identical with the one for their inferior spirit or ghost, "Wonda," and I can easily conceive how, from absence of careful investigation, such an error would arise, and for which I believe there is no other foundation.

At certain periodical seasons, the women retire to a certain distance from the camp, where a few sheets of bark are put for them, and during such retirement, none but females and children visit the spot. I have seen the men go considerably out of their road when approaching the camp, rather than pass close to the place where a woman is under such circumstances. They have a superstitious fear, that were they to do so, some evil or ill-luck would befal them. This is strictly adhered to, and forms a marked feature in their customs. I am not aware whether such rules are known among the coast or other tribes, but I think it most probable they are.

Their system of courtship, and of obtaining helpmates, is much the same as is practised among other savage nations, betrothal, forming the leading feature. Girls, at an early age, are given or betrothed to some man of the tribe, who may probably have

two or more wives already, and on the girl arriving at womanhood, she is sometimes given to some young man, who may have found favor in the eyes of her anticipated lord and master. An impetuous lover will at times pounce on an unfortunate female of some other tribe, and carry her off against her will, and much cruelty is often the consequence (but this is not the ordinary mode of courtship, as has been stated by some writers.) Raids are also occasionally made for this purpose, on neigboring tribes, and may be considered as a minor imitation of some episodes in the peopling of the Roman republic. But the consequence in such love episodes, becomes serious, when the ravisher is called on, as is the usual custom by the brother or friend of the lady—either to give up his forced bride, or maintain with boomerang or spear, his conquest against such comers as may be decided on by the elders of the tribe interested. These abductions and raids not unfrequently lead to a system of retaliation, which ends in a general *melee*, when old scores are wiped off. In time, similar outrages occur, which are in like manner again disposed of. I once had an opportunity of witnessing the tenacity with which the chiefs of a tribe exercise their right in maintaining their laws and customs. A young man who had absconded from his relations, and contrary to their wishes associated himself with some neighboring tribe, wishing to be re-admitted to his friends, had to present himself before his natural chief for trial. After his examination, he was sentenced to have a certain number of war boomerangs thrown at him by certain men, there and then appointed for that purpose; the distance was some 80 or 100 yards—a small heliman (a shield) only being allowed him as the means of warding off the missiles. The lad was evidently frightened, but took his position manfully, and much excitement was felt by those present who were not in the secret—myself among the number. After some two or three boomerangs were thrown, considerable surprise was evinced on seeing them fly wide of the object, although thrown with an apparent earnestness. On after inquiry we found that the sentence was carried out merely for form sake, so that no precedent injurious to the maintenance of their law should arise to be used on future occasions.

Much has been said of the imprudence of these poor creatures, and I do not intend to deny the general truth of such statements, but I believe that, had we been better acquainted with their habits before the colonists came among them, we should give them credit for more thoughtfulness than we now do. In corroboration of this opinion I may inform you that, during an exploration trip into the interior, made by me in 1836, I found a considerable store of grass seed, gum from the Mimosa, and other stores, carefully packed up in large bags made from the skin of the kangaroo, and covered over with pieces of bark, so as to keep them properly dry. The weight of the bags, containing the grass seed and gum, was about 100 lbs.; the seeds had been carefully dried after being collected from the small grasses of the plains. It is used as food after being ground into a kind of paste. The gum is, also, one of the favorite articles of consumption, and when made into a thick mucilage and mixed with honey, or sugar, is really very nice. Such instances of forethought are doubtless rare, and, I believe, are only to be found beyond the influence of civilisation.

Having seen the great change that has taken place in the Kommilaroy tribes during the last thirty years, in which hundreds have dwindled in many sections to units, I can come to no other conclusion but that the advent of the white man has been most disadvantageous to them, for as nothing has been done that has improved their condition, the natural consequence from the contact of the colonising race has been that their customs and superstitions have been thrust aside, the chiefs and headmen of the tribes have become powerless, and the influence they once possessed has been destroyed; in other words, the contemplation of our civilisation has left them more helpless and degraded than when they first beheld us, and in a few years more nothing will be left but a few border tales to remind posterity of their traditions or existence.

Since writing the paper I have read to you this evening, my attention has been called to a little work on the "Language of the Aborigines of Western Australia," published by George Fletcher Moore, Advocate-general of that colony, and I there find that the most remarkable customs described by me are recognised and in use among the aborigines of the Western coast. This, to me, is very gratifying, as it may, I think, fully be taken as corroborative of my past experience on this subject.

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THE CONSTRUCTION AND ARRANGEMENT OF HOSPITALS:

A Paper read at a Meeting of the Philosophical Society, June 25, by R. GEORGE SUTER, M.A., Architect.

The sanitary treatment of that portion of a community which from circumstances is unable to secure other than gratuitous advice may be generally classed under two heads, Construction or Arrangement, and Management or Administration. The latter is purely the medical portion of the subject, and can be adequately treated by the profession alone. The former is the province of the architect, acting by and with the advice of the medical staff, and bringing to bear on the subject the united force of common sense, professional skill, and the results of experience. It is the privilege of a new colony to reap at once the benefit of those lessons, political or social, which the mother and other countries have learnt only after long and, perhaps, painful experience, and in proportion as these results are appropriated or neglected, the greater will be the advantages enjoyed or the blame incurred. Amongst the demands upon the better feelings of our nature, whether individual or national, the care and restoration of the sick and infirm may be reckoned the earliest, and if in answering it judicious counsels prevail, and advantage is taken of those arrangements and appliances which modern thought and skill have introduced, the end aimed at will be more speedly attained, with greater economy as well of money as of human life. Steps have already been taken in this colony towards the establishment of good hospitals, and Brisbane will shortly count amongst its social institutions a building which will form no mean addition to the city improvements. On this ground, perhaps, something of an apology is due for troubling you with this subject to-night, inasmuch as it may be said that, the initiative having already been taken, any further discussion is uncalled for. Having, however, been called upon by the Parliamentary Committee to give evidence on the subject, it occurred to me that the few notes I have been able to collect at home and in the colony might not be wholly unworthy of your attention, or at all events might be productive of good by calling out the ideas of those who have given the subject their attention, and who from their position and interest are qualified to express an intelligent opinion. Since the close of the Crimean war the subject of Hospitals has received so much attention that the qualities good and bad which they possess are now fully known, and to erect a new building on an old and exploded plan, and without the advantage of modern improvements, would be an anachronism little short of criminal. The object, therefore, of this paper will primarily be to ascertain how far these modern notions can be brought to bear in this country on our hospitals and infirmaries, and to what extent the new arrangements now in force at home can be acclimatised and made to satisfy the demands of a different and warmer country. In doing this, I must very briefly ask you to assist me in building an hospital on modern principles, incorporating the arrangements and appliances which are now considered necessary, and adapting them, as far as practicable, to our different climate. Once for all, I must premise that I wish to avoid every appearance of dogmatic assertion where there is the least room for difference of opinion—rather my aim will be to lay before you certain propositions which may lead to the exchange of ideas and

be productive of good by increasing the utility of our Queensland hospitals in the greater care and more speedy recovery of their sick inmates. It cannot be too frequently urged that this last is the chief aim to which all hospital management should be directed, and the more speedily the patients admitted are sent out again restored, the greater the success of the institution. Hospitals at best are but necessary evils, and collective care and attention can never be the same as individual. Badly contrived and ill-arranged, they are a curse rather than a blessing, and tend to destroy rather than to preserve human life. In the Crimea it is a well ascertained fact that of the sick who were placed in bare huts and almost entirely exposed to the elements during the fearful winter of 1854-55, not more than half died of the number that perished during the same period within that by-word for horror and misery—the hospital at Scutari. During the famine in Ireland and the fever that followed it, there was a marked contrast between the number of deaths and cases treated in the open air and under hedges, compared with those of the same class treated in the workhouses and hospitals. In the wooden huts at Balaclava, which held from 15 to 30 patients, the mortality was under 3 per cent. of cases admitted, while at Scutari the mortality was 42·7, or nearly 43 per cent. on the cases admitted. The medical men will, I believe, confirm me in saying that a patient ill with the small-pox has greater chance of recovery in an open shed and lying on clean straw than in many hospital wards. By the kindness of His Excellency, I have been furnished with a copy of the interrogatories issued by the Home Government to all the colonies, in the year 1863, on the subject of the local institutions for the treatment of the sick and insane, and also with a copy of the minute drawn up in consequence, and sent in reply to the information so obtained. The whole tendency of that document goes to prove the unmitigated evil arising from the formation and management of hospitals on wrong and defective principles. On the present occasion, I must be understood as referring to the hospitals and general infirmaries only. The subject of lunatic asylums will call for special treatment, while there are collateral questions of drainage and water supply which we can only allude to in passing. In hospital building the seeming paradox may be considered as holding good, that while economy must be rigidly studied, money must, at the same time, be the last consideration. If, as will generally be the case, funds are but small, it will be found better—and the hospital will be more successful—if a fewer number of patients are provided for, and the building thoroughly complete with all modern improvements and appliances, rather than to erect a large building capable of holding a great number of patients at one time, and with that aim only, and deficient in the means for *speedily* restoring its inmates to their homes recovered. Our first point in founding a hospital must be the locality and site. In a new country such as our own, we can hardly from circumstances do otherwise than place our infirmaries in the same relative position as that now held by most county hospitals to the smaller county towns—that is, just outside the Municipal boundaries, a position which has been proved by statistics to be the most healthy and convenient. The want of fresh air and of a constant change in it is not compensated by close proximity to those who require hospital services, and thronged thoroughfares or localities liable to be built upon should be avoided. On the other hand, if outpatients are to be accommodated (although it would be often better could the two be kept entirely distinct,) the hospital must not be placed too far out of reach, so as to cause them a tedious or long journey. A large area of ground should, if possible, be acquired, to enable the formation of gardens and airing grounds, and also to render the hospital at all times independent of the surrounding localites should they hereafter become thickly inhabited. The ground chosen for the building site should be elevated, with a natural fall for the surface drainage every way; the soil should of course be dry, and if possible gravelly or a porous subsoil, but at all events neither low nor swampy. Proximity to tidal rivers or creeks, where the mud-banks are exposed at intervals should be carefully avoided, as also the neighbourhood of manufactories, slaughterhouses, or chemical works. To shew that with every precaution against it the influence of malaria is often very destructive, and the proximity of places where it is generated much to be avoided, it is stated of the Lariboisiere Hospital, in France, on good authority, that a wind blowing for a few hours from the direction of a malarious quarter of the town was of sufficient influence to give a malignant character to previously healthy sores. The site chosen, the next step is the plan and arrangement; and several requirements apparently conflicting meet us at the outset, all demanding more or less attention. The chief *desiderata* in a good hospital plan, in England, are sunlight and fresh air. Formerly the rule was to exclude the light, but it has been proved over and over again that with certain exceptions patients recover sooner where the rooms are flooded with light, and seldom will a physician now as formerly order the blinds of a ward or room to be drawn down, but rather the reverse. In this country, however, the case is somewhat altered, and although we do not require gloom or dullness we cannot be exposed to the glare and heat of the sun's direct rays. But if we are compelled to exclude the sun, *a fortiori* are we obliged to give every facility for the admission of air, of which, so long as we avoid drafts and sudden changes,

we cannot have too much. Into the exact quantity required we will enter presently; the question now is how to arrange our buildings so at to command the greatest amount of pure air within and around them. One great essential consists in the constant movement of the air in mass. The motion of the air in any ward or room should not exceed $2\frac{1}{2}$ feet per minute, but should never be much if anything below it. No stagnation must be permitted, and great errors have been in past times committed by enclosing open courts with lofty ranges of buildings forming closed angles, quadrangles and narrow *culs de sac.* Figures 1, 2, 3 in diagram represent existing hospitals of this character, all of which should be rejected as models of imitation. The simplest form of hospital construction is a straight line as in figure 4 on diagram (A), with window openings on both sides, the wards being the lengthways of the building, and the administration in the centre. The axis of the building should be so placed as to gain the full force of the prevailing breeze, that the wards may be constantly blown through. If the building be two stories in height (and no hospital should be more) this plan would accommodate 120 beds with economy and efficiency. Additional ward space may be obtained by adding short wings as in figure (5), but two staircases would then be required, care being taken, however, not to prolong the arms too much to aggravate the evils of the closed angles which the plan involves. A better arrangement, however, is to be found in figure (6), the wings being separated from the centre and connected with it on the lower floor only by a covered corridor. This plan is adopted frequently in France, but its great disadvantage consists in not easily admitting of extension. Taken as a whole, the plan which is now most in favor as combining in its arrangements the chief requisites of a hospital is that of figure 8 on diagram B. The wards are divided into separate blocks, each block being, as it were, a distinct hospital by itself, and connected with the rest and with the administration by a corridor enclosing garden and airing grounds. On this plan, or slight modifications of it, are built the hospitals at Bordeaux, Brussels, and Lariboisiere at Paris, and in our own country at Leeds, and the new St. Thomas', now erecting, in London. In the Lariboisiere the corridor is covered with a flat roof, forming a promenade or airing ground for the convalescents. This plan is known as that of the *pavilion principle*; and taking into account the requirements of our climate, I look upon it as the one of all others we should best adopt—limiting, however, the blocks to one storey only in height, for reasons which I will hereafter allude to. The axis of the whole system of wards should be so placed that they may receive the full benefit of the prevailing breeze, and their distance apart sufficiently great to admit of each receiving its full amount of fresh air as an independent building. The nature of the ground selected may sometimes prevent this plan being carried out, but I think its principle should be aimed at, as thoroughly combining the great requirements in hospital building—subdivision of the sick, free ventilation inside and around, and convenience of access for administration. The ground plan settled, we have next to determine the wards, their size and character; and having secured our fresh air, to turn it to the best account. The wards should be of such a size and so arranged that the head nurse can have all her patients under her eye at once, especially at night, whereby a great saving is effected in the nursing staff. One head nurse only to each ward is desirable; therefore the number of patients must be such as fully to occupy her attention, but not more. Small wards on this account are expensive, and demand additional nurses. They are sometimes said to be preferable to larger ones, as giving greater privacy, and also increased facilities for ventilation. These, however, are fallacies, for there can be no privacy in a hospital beyond any two adjacent beds; and as to ventilation, the multiplication of angles has not sufficiently been taken into account. In some experiments at Lariboisiere it was found that the amount of air circulating down the centre of a ward is two or three times greater than that near the sides and angles; and it seems to be overlooked that the difficulty of ventilating a given cubic space occupied by sick, bears a direct ratio to the length of the corridors and to the number of cells or wards into which that space is divided. Figures A, B, C, D, on diagram B, are instances of wards which should be avoided. Another objection to small wards consists in the greater facility they afford to insubordination,—a small number of 6 or 8 can more easily combine for mischief than a greater number. Natural ventilation is the only efficient means of restoring the sick, and the amount of fresh air required for ventilation has been hitherto much underrated, as it was supposed that the carbonic acid gas produced by respiration was the chief noxious gas to be carried off. The total "amount of this gas produced by an adult in 24 hours is about 40,000 cubic inches, which in a ward or room containing 16 men would give 370 cubic feet per diem, allowing 8 hours for the night occupation of such a room when the doors and windows may be supposed to be shut, the product of carbonic acid would be 123 cubic feet, or $15\frac{1}{2}$ cubic feet per hour, nearly. This large quantity if not speedily carried away would undoubtedly be injurious to health; but there are other gaseous poisons produced with the carbonic acid which have still greater power to injure health. Every adult exhales by the lungs and skin 48 ounces, or 3 pints, of water in 24

hours; 16 men in a room would therefore exhale in 8 hours 16 pints of water and 123 cubic feet of carbonic acid into the atmosphere of the room. With the watery vapour there is also exhaled a large quantity of organic matter ready to enter into the putrefactive condition. This is specially the case during the hours of sleep, and as it is a vital law that all excretions are injurious to health if re-introduced into the system, it is easy to understand how the breathing of damp foul air of this kind, and the re-introduction of excrementitious matter into the blood through the function of respiration, will tend to produce disease." If this be correct for those in health how much more will it be so for the sick, the exhalations from whom are so much the more dangerous, as they form one of nature's methods of throwing off noxious matter from the body? To obtain the amount, therefore, which is necessary, experiments have proved that a ward should not be less than 15 feet in height, thus giving to each bed in a ward of 20 beds 80 feet long, and 25 feet wide, a cubical space of 1,500 feet. But this is not all. We require also a certain amount of superficial area, for the loss of which cubical space will not compensate. The usual hospital bed is generally 6 feet or 6 feet 3 inches by 3 feet or 3 feet 6 inches, and allowing the bed to stand a little distance from the wall these figures will give an area of 21 or 24½ square feet for the bed itself. Besides this we want space for the unimpeded movement of 2 or 3 round the bed, for a night chair, and perhaps bath, without incommoding the adjoining patient. Between the feet of the beds on the opposite sides there should be room for a moveable dresser or table and a form, leaving also a clear gangway. Taking all this into consideration, a superficial area of 100 feet for each bed is not too much. The following table gives the cubic and superficial allowance to each bed in several modern hospitals :—

	Length of ward.	Width of ward.	Height of ward.	No. of beds in each ward.	Cubic feet per bed.	Superficial area for bed.
	Feet.	Feet.	Feet.			
Leeds	110	26	18	32	1732·5	96·25
Bombay	65	25	18	16	1828.12	101·5
Bristol	—	—	—	—	1090	—
Preston (Lancashire)	—	—	—	—	1900	—
Liverpool (Fever) ...	—	—	—	—	1500	—
New St. Thomas' (London)	120	23	15	28	1800	120
Herbert (Woolwich)...	115	28	15	32	1500	100

The diagram is meant to represent a ward rected on these principles, being a slight moification of that adopted in the new hospital Leeds. In the original the number of beds 32, but to suit our climate I have reduced at to 28, and have not included in the dimenons the angular piece at the end of the room, that the actual figures of allowance of space each bed would be something in excess of those given, and I do not think 2,000 cubic feet per bed will generally be considered excessive. These are, as will be seen on the plan :—Length of ward, 110 feet; width, 23 feet; height, 18 feet; No. of beds, 28; cubic feet per bed, 1,980; superficial area, 110 square feet. The figures on diagram E give a section of the pavilion at Leeds, with an external elevation of the windows, and one of the latter to a larger scale showing the method of ventilation. Our ward, therefore, having this capacity, how is it to be filled, emptied, and refilled in continuous succession? The answer is, as we have said before, by natural ventilation only. All artificial systems have more or less proved failures, and nothing short of open doors and windows, or similar apertures will avail. In the diagram before you there is a window between every two beds which is in height 13 feet, and 4 feet 9 inches in width; or 61 feet 9 inches clear space for air. There is also a window at the end. Generally, these windows are made as sashes to slide up and down, by which I am inclined to think a greater command is obtained over the quantity of air admitted, and over the height of its admission. At Leeds, an elaborate and rather expensive system of double glass louvres has been adopted. The windows are brought to within 2 feet 6 inches of the floor, enabling the patients to look out from their beds. Advantage is taken of the mediæval character of the building and of the windows to obtain additional openings for air above the lights communicating by air trunks. formed in the thickness of the floor, with openings in the floors and ceilings. The wards are warmed by open fireplaces in the centre of the room, with descending flues, the heat of which is employed to draw in the external air. Before going further, I wish to draw your attention to the diagram F, which gives a plan of the European general hospital at Bombay. I am sorry that I have no better specimen of a hospital in a warm climate to put before you; but in truth they are not numerous, and all the instances adduced in the home Government minute are samples of things to be avoided. The general particulars are figured on the drawing, and the building is three stories in height—the two upper being used as the hospital, the lower for staff residences, casual and accident wards. The dimensions of the building are as under :—Length of ward, 65 feet; width, 25 feet; height, 18 feet; number of beds, 16; cubic feet per bed, 1828·125. The plan, as will be seen, is on the pavilion principle, and the hospital is placed facing the west, from which quarter a pleasant sea breeze is blowing throughout the year. I specially bring this before you, because the mode of ventilation as described might, with some modification, be adopted here. "The ventilation of the wards," it is said, "is carried on by the windows, which are very lofty and placed

opposite each other. The lower part of each window has casements opening as doors. The upper part has casements hung at the bottom to transoms, and opening inwards. Ventilating openings are also provided close to the ceiling. In each window frame there are also hung, not only glazed casements opening inwards, but also casements fitted with venetian blinds or jealousies opening outwards; and it is also proposed to supply means of closing when necessary the outer openings of the verandah." The administration is conducted in the two ends of the building, the chapel, operating, and nurses' rooms occupying the centre. Before describing more in detail the ward as adapted to this climate, let me draw your attention to the remaining features of what we will call a model ward as now built in England. It will be seen that the only rooms attached to the ward as offices are, a room for a head nurse, with a window overlooking the whole ward and a scullery. Offices as such should be limited to these The closets and lavatories are placed at the extreme end of the building, set on the angle, and cut off from the ward by a separately-lighted and ventilated passage; the windows being so placed as to allow the air to pass through them without contaminating each other, or the ward. Attached to the ward, but at a lower level on the staircase is a small ward for a single patient if required on an emergency, and leading out from the corridor is a day-room for the convalescents to which we shall have to allude presently. The small block plan in red shows the general disposition of the whole hospital and the relative bearing of the several wards to each other and to the administration. Having gone through the main features of a model hospital at home, I now venture at the risk of some criticism to suggest the form that a hospital in this climate might be made to take. I wish, however, entirely to avoid all dogmatism, and hope that my statements will be taken for what they are worth, and confirmed by those who have had opportunities of judging as correct, or disproved as untenable. There can, I think, be no question that the pavilion principle is that to be adopted here, and I shall not take up your time by further discussing its merits. A plan and short description of a hospital for say two hundred and twenty-four patients will perhaps best explain what I wish to say. The plan on diagram is a ground plan of the general form the hospital should in my opinion take—the administration being in the centre, and the wards containing twenty-eight each on either side connected with it and with each other by a covered and latticed corridor. Another and sometimes convenient form might be that of radiation—but the objection to such a plan is, that while it is convenient for administration it fails to give all the wards the full benefit of the prevailing breeze, and is withal not well adapted for extension. Figure C is a section of one of the wards. It is raised 6 feet above the general level, on open piers or arches, to allow of a free current of air all round, and to afford opportunity for constant examination and cleansing of the floor timbers; the walls to be built of brick or stone, and formed hollow, to obviate the effects of the heat and damp, and preserve the inner temperature as uniform as possible. I retain the dimensions already mentioned; but I would confine the height of the building to one storey only. The most healthy hospitals have been those with one floor only, and this because they require less scientific knowledge and practical care in ventilation. If another floor is added a community of ventilation exists between the ward below and that above by the common staircase, and by filtration through the floor. There is, I believe, a well-founded notion that patients do not recover so quickly on upper floors: and there are instances where the mortality has been greater on upper than on lower floors. Moreover, a sick population require more surface for health than a healthy one, and it is clear that if patients are placed on 3 instead of on 2 floors, the surface overcrowding is increased by one-third, unless the distance between the pavilions is increased in a corresponding ratio. Another reason for one floor only arises from the form which I venture to suggest for ceiling and roof. The roof should, I think, be double, enclosing a clear space of 12 inches at least between the outer and inner covering, for the same reason that the walls are hollow. As I have said before all angles cause the air to stagnate, and as has been proved by experiment it moves 3 times faster in the centre than at the angles. If a circular form is given to the roof, and at the apex a portion of the roof is raised with outlets for the vitiated air, the difficulty is lessened if not removed. The sides of this portion of the roof I propose to enclose with venetian blinds, protecting them from the rain by widely projecting eaves. The windows I would make lofty, and bring them low down near the floor line, forming them as sliding sashes or French casements as approved. I rather incline to the former, leaving some as casements for access to the verandah; and fitting all with sliding venetian shutters hung up and down. The verandah is of course indispensable, and I would make it very wide, but as it impedes to a certain extent the free admission of air through the windows, the covering should have a double form as shewn, or entrances should be formed for the air above the verandah level. This, however, is a matter of detail. The verandah should be almost exclusively used for keeping off the sun from the walls of the ward, and I would neither appropriate it for the use of convalescents nor for offices of administration. There might cer-

fairly be occasional exceptions in favor of the former, but I propose to deal with them in a different way. The level of the verandah should be a little lower than that of the ward to prevent the surface water getting into it. I do not think the relative position of the nurse's room, scullery, bath room and closets need be altered from that shewn on diagram D. Greater care, however, must be taken to cut off the air with which the latter are surrounded from that of the ward; and this brings me to a very difficult part of the subject. The adequate drainage of a hospital in this climate would of itself afford materials almost for a separate paper; so many and various are the difficulties to be surmounted. The possible want of water is an item of consideration which is most important, and on the solution of this must depend, in a great measure, the course to be adopted. For the present, however, we will assume that by means of the water works, cisterns and other appliancse we have an ample supply, and the question is how the sewage and refuse matter are to be removed. The drains, without question, conveying it from the sculleries and closets should be as much as possible external to the building and properly trapped, but where are these drains to discharge? Except at a very great distance from the hospital, and indeed any other human dwelling which the expense would virtually preclude, it would be folly, and worse, to discharge it into a neighboring stream or ditch, more especially if that stream happened to be tidal. Again; to attempt to use the sewage as manure in its natural state and undeodorized on land in the neighborhood of the hospital would be, to say the least, hazardous. I propose, then, as the only alternative, to meet the difficulty boldly, and, with the full certainty of provoking sharp criticism, to suggest the old and ugly-sounding word "cesspool," modified and disarmed, however, I hope, of its usual terrors. All drains being constructed, as far as possible, external to the building, I would make them deliver into a cesspool or tank at some convenient distance, carefully constructed and arched over, with ready means of access. The connection of the drains with the cesspool should, in each case, be properly trapped; and to prevent the evils arising from the inevitable generation of gases within, I would connect the cesspool with the external air by a tube delivering at a point quite above the hospital, or, better still, where practicable, into the chimney of the furnace of the steam-engine which would not unfrequently be required for pumping and other uses. By means such as these the great sewers of London are frequently ventilated. The cesspools should be constructed so that the contents may not soak away and impregnate the soil, but be retained for a time till opportunity is given for emptying. This process can very easily be effected by an air pump and exhausted barrel or receiver, which properly worked would quickly remove the contents without the slightest offence to sight or smell. The process and apparatus are much in use in Germany, and I believe it has been tried in Melbourne. The barrel when filled can be sent away, and its contents deodorised at some safe distance and turned into manure for the land. Into this question, however, we cannot now enter, as of itself it would afford ample material for a separate paper in connection with the drainage and health of towns. I cannot discuss this part of the subject without alluding to a system which has found advocates in England, and many also in these colonies, particularly in Melbourne. In criticising it I am certainly at some disadvantage, having never seen it in actual work; but I know it well by description and plans. I refer to the earth closet, and must confess that I cannot get reconciled to the idea of adopting it. Whether it be effectual or not, or cleanly and wholesome or not, in a private house, I will not undertake to say; but I am pretty sure that in a mixed assemblage of characters of all kinds, such as are generally found in hospitals, any scheme involving so much individual attention, and the utility of which is so completely and entirely frustrated by the slightest omission in carrying out its requirements, has much to contend with at the very outset, and I have considerable doubts as to its working well in a hospital. On the other hand, I find in the *Builder* for this month, "that some very interesting experiments had been made in the gaol at Alipore, near Calcutta, by Dr. Faucus, of the Bengal Medical Service, and published in the last number of the *Indian Annals of Medical Service*." The writer says:—"They are the best and most conclusive of any that he has ever met with, and in all hot countries ought to lead to practical results;" and adds "that earth containing *much* organic matter should deodorise fæces more rapidly than earth containing little organic matter, as the experiments of Dr. Faucus seem to prove, will be a new and practically valuable fact for sanitary reformers." The editor of the *Builder*, no mean authority in these matters, and from whom, in compiling this paper, I have received great assistance, says that "a person advocating the earth closet in towns or places where there is the least attempt at water supply ought to have his head shaved." But without going this length, I think we should be unwise to adopt this system in a public institution without greater proof of its success, and without some attempt at ensuring its right and proper action, independent of caprice or inattention. With regard to day rooms, I think, where possible, that they should not be in the same building with the wards, but attached to the hospital, and in the most pleasant portion of the grounds. I would build a few cottages, to

which a convalescent, the moment he is able to leave his bed in the ward might be moved. His entire recovery would be sooner effected, both by change of air and scene. Attached to these cottages should be airing grounds and gardens for gentle exercise and amusement. It seems to me that a patient who can leave his bed for a day room, ought to be retained in the ward no longer, but give up his place to another. Several other branches of the subject still remain to be treated, but time will not allow me to trouble you with them to-night, and I prefer to allude to them by name only rather than do them injustice by too casual a notice,—such, for instance, as the proper materials for the floor, walls and roofs of the wards; the proper position, size, and number of the offices; administration, and other departments; and last, though not least, the provision to be made for out-patients, and system of management to be adopted in relieving them, all of which must be left for another opportunity or relinquished. Very briefly, however, it may be stated that the use of wood should be reduced to a minimum,—that the floor should be built on brick arches and laid with hardwood, oiled or rubbed; the walls rendered with Parian cement brought almost to a polish. For out-patients, the waiting-rooms should be so arranged that the sexes may be separated, with alternate access to the physician or surgeon in attendance. Enough has, I trust, been stated to give proof, if any were wanting, of the immense importance of the subject, and I shall be gratified if anything I may have said should be the means of directing yet closer and more searching attention to the various points insisted on. On one part of the subject—that of cost—I have been purposely silent, and will at once admit that the system I have been recommending is the *most costly* as to the *first outlay*. It must be remembered that the duty of a hospital is not to harbour the infirm, but to receive the sick and restore them to health as quickly as possible. A well appointed institution on a small scale will in the end be more successful than a larger ill-arranged, and badly managed infirmary—and in considering the cost we often have cause to remember that the very existence of a hospital is in a great measure *vindictive*—a stroke of Nemesis for our neglect in the proper drainage of our streets and houses, and in the use of due precaution against disease. I do not mean to trace directly the presence of all the patients in a hospital to the want of drainage and general cleanliness, but most assuredly a great portion of the diseases there treated may be traced directly to those causes, and a still greater proportion indirectly. Discomfort at home and bad smells incite to drinking and other vices which fill our hospitals, and if we would but see this, and turn our energies in this direction at first, we should not unfrequently have to pay less, but, what is of more importance, should save many a life that is otherwise lost to the community, and help to raise the tone both moral and physical of that portion of the community which stands most in need of it.

Since this paper was written, my attention has been kindly drawn by Captain Pitt, R.A., to the report on the Military Hospital lately erected by the Home Government at Woolwich. This institution is built on the pavilion principle, and the plan and general management are in every respect confirmatory of the views I have endeavored to maintain.

NOTE :—Diagrams in illustration of the various plans were exhibited, to which reference is made in the preceding paper.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, August 7, 1866.)

At a meeting held on Monday, July 30, 1866, the President of the Queensland Philosophical Society, Chief Justice COCKLE, F.R.S., read the following paper—

ON THE INVERSE PROBLEM OF CORESOLVENTS.

Inverse problems, as is well known, present greater difficulties than direct ones. For instance, while it is easy to square a number, it is not so easy to extract its square root. Moreover, there are cases in which it is impossible to obtain a finite solution of an inverse problem. The solution of a quintic is usually considered to be such a case. In the theory of co-resolvents it is comparatively easy to pass from the algebraical to the differential resolvent, but the converse does not hold. The finite integration of the linear differential resolvent of a given algebraical equation would perhaps be a step towards the general solution of the inverse problem. But that integration has not yet been effected except in two or three special cases, and the definite integrals of Boole have not, that I am aware of, been converted into indefinite ones. In order to take the step above pointed to, it seems to me necessary to have recourse to a non-linear differential resolvent, to be constructed as follows:—The elements of the final non-linear are three. The first is (1) the second differential co-efficient of the dependent variable; the second is (2) the first differential co-efficient of that variable; the third is (3) the square of the second element divided by the dependent variable itself. The sinister of the non-linear resolvent is constituted by the six homogeneous quadratic products of the three elements, and is the sum of those six products, each multiplied into an indeterminate or conditional multiplier. Each element, and each product, is, as we know by the theory of coresolvents, in general capable of being expressed as a rational and integral function, of the dependent variable, of a degree less by one than that of the given algebraic equation. Suppose this last equation to be a quartic. Then each product and consequently, the dexter of the non-linear resolvent can be expressed as a cubic function of the dependent variable. Let the dexter of the non-linear be reduced to zero by causing the

several co-efficients of the cube, the square and the first power of the dependent variable, and also the absolute term, to vanish separately. These four conditions, while they reduce the dexter of the non-linear to zero, enable us to eliminate four of the indeterminate multipliers from its sinister. No elevation of degree will arise from the elimination, for all these four conditions are linear. The co-efficients of the six homogeneous quadratic products on the sinister will now in general be homogeneous linear functions of the two uneliminated indeterminate multipliers, and, by the solution of a cubic only, the ratio of these two multipliers can be so assigned as to cause the sinister to break up into linear factors, each factor being a linear and homogeneous function of the three elements. If we apply the exponential substitution, to either of these factors equated to zero, the resulting final non-linear differential equations of the first order are of a soluble form. We have thus constructed a soluble non-linear differential resolvent of a general biquadratic. For a cubic we might dispense with one of the homogeneous products, and consequently with one of the indeterminate multipliers, but we should thus be led to a resulting cubic, and it will be better to retain the whole six terms of the sinister. We shall then, having only three conditions of evanescence to satisfy on the dexter, be able to break up the sinister into linear factors, as before, by means of a homogeneous cubic in the three remaining disposable indeterminate multipliers. Applying, to this last cubic, the method of vanishing groups, we see that its solution depends upon the solution of a quadratic equation, and the extraction of a cube root only. In the case of a quartic, the integral obtained by the foregoing processes involves two arbitrary constants only, and its nature and extent requires further discussion. But it seems that, by means of the theory of co-resolvents, we obtain new methods of solving algebraic equations up to the fourth degree inclusive; and, although the above discussion does not embrace equations whose degrees exceed four, it apparently indicates that further results may spring from the study of non-linear differential resolvents.

At the conclusion of the reading of the above paper by Chief Justice Cockle, Mr. Suter read the following remarks, with reference to a paper read by him at the last meeting of the Philosophical Society :—

In reference to the paper read at the last meeting of the society and the mention made therein of the new Hospital now building, Mr. Suter wished to say by way of explanation that he had purposely avoided, from motives of delicacy, giving any detailed account of the plan and arrangements, seeing that the building was not complete, and any judgment on it must therefore be necessarily premature. Since the meeting, however, he had had an opportunity of going over the works, and Mr. Tiffin had very kindly shown him the drawings and plans, and it was a matter of great gratification to him to find that the positions he had advanced were to a very great extent supported by Mr. Tiffin, and carried out by him in actual practice. The new hospital would, under somewhat difficult circumstances of position and locality, combine most if not all the requirements demanded by the increased knowledge and skill of modern times. The wards were spacious and well ventilated, and the amount of cubical superficial area per bed, if not superabundant, was at least adequate. By the arrangement adopted, the wards were for the most part broken up into detached portions, each forming as it were a hospital complete in itself, and provided with all the necessary accommodation of baths and lavatories. Thus all risk of contamination and infection was reduced to the minimum. Had the site presented fewer difficulties, and the resources at Mr. Tiffin's command been less limited, he would doubtless have preferred a different system of drainage, and the adoption of other appliances required in a hospital; but notwithstanding the very few drawbacks already alluded to, it was very gratifying to feel that full advantage had been taken to erect a hospital worthy of Brisbane, and which will prove not only an ornament to the city and a credit to the architect, but a blessing to the people.

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THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, August 29, 1866.)

At a meeting of the Queensland Philosophical Society held on the 27th instant, the Rev. James Matthews in the chair, Mr. Tiffin read the following paper

On the Use of Earth Closets as a Means of Preventing the Vitiation of the Air.

The vexed question of perfect sanitary arrangements involves several considerations; hence a rough outline of some few of them by way of introduction will perhaps better clear the way to what I have to elucidate, than by plunging at once into a description of the "earth closet," and its supposed advantages as a sanitary appliance.

First of all we have to consider the ends sought to be attained by sanitary appliances. These are, it may be conceded, comprised in the three great wants of mangood food, clean water, and pure air; these three, although inextricably connected in many points, are capable of being treated of separately. It is to the last, therefore, I would wish to confine to few observations which are to follow.

To attain pure, scentless, speckless, life-giving air millions on millions of wealth have been, and are now being, expended in all the great and little centres of population throughout the civilised world. The air of towns is thick with with soot, dust—dust impregnated with the droppings of all kinds of cattle and birds—odours and gases foreign to the component parts of air, which are four parts of azotic and one part of oxygen gas. Dr. Robinson, in a paper read before the British Association, says, in reference to one of the above-mentioned classes of "organic effluvia": —"The third class of organic effluvia is one to which I attach great importance, from the belief that not only are those volatile organic matters often, perhaps generally, poisonous in themselves, but that they are also injurious to an incalculable extent by sheltering, nourishing, and so propagating the noxious germs liable at all times to be suspended in the atmosphere. And if it can be demonstrated that volatile organic matter is present, under certain circumstances, in the air surrounding us, there is no more difficulty in believing it capable of nourishing and contributing to the growth and development of contiguous germs, than in supposing the animalcules present in water to derive their chief support from the animal and vegetable matters dissolved or suspended in it. That organic matter is present in the atmosphere might at once be inferred from the varied odours proceeding from plants and animals, and from the injurious effects exercised on living animals by exposure for a length of time to accumulations of such effluvia. But modern chemistry has converted this probability into a certainty. Vauquelin, on analysing the liquid obtained by the decomposition of marsh dews, found in the residue an organic substance which blackened or charred on exposure to heat. Zimmerman has described, under the name of 'pyrrhine,' volatile organic matter universally present in rain and snow water." I need not call to mind the determination arrived at by the scientific men last year, that rinderpest was conveyed in the air—so likewise cholera; and fevers, consumptions, and scrofulous diseases are propagated by the agency of the atmosphere. Now, observe particularly that it is "volatile organic matter" that renders the air dangerous and impure, and the damp dewy night air more so than the air of day which the sun's light and heat penetrates—and it will be seen at once that this "volatile organic matter" cannot rise from any dry substance, but must generate in moisture somewhere. It originates in the decaying carcase of an animal just dead with all the natural juices so recently coursing through it; it originates in some rotting heap of vegetation scattered here and there; it originates in the ooze of swamps, cesspools, drains leading nowhither, and the slop-holes of every house and hovel in this land and every other land. It does not originate in the clear flowing river or the wide-rolling ocean; nor does it originate in the parched and dusty country where heaps of bones lie bleaching in the sun.

Now, it is clear that everything that tends to dry up those oozing beds of filth which lie everywhere around, from which are continually being disengaged prolific crops of noxious volatile matter, like so much thistledown, tends to make the life of every human being more endurable, by reducing the air we breathe to something more like its normal state. Now,

what is contended for the earth-closet is, that it would materially assist in promoting this very desirable state of the atmosphere, by preventing the accumulations—the costly accumulations—of ooze in every back-yard in the country. The commercial value of soil from the "earth closet," as compared with the ooze of cesspits, will bear mention further on.

As things are, in every civilized city, town, or village in the world, there are three kinds of filth which accumulate wherever two or three people are gathered together. 1. Slops; 2. Ashes; and 3. Ordure. If the three could be kept quite separate—they are in some few places here and there, so therefore the *if* is not very awkward, —and be removed separately, not so much evil would accrue to the air. The slops can always be disposed of when there is a flow of water, as there is now from Enoggera, which is quite adequate to diluting them to harmlessness; but when the contents of closets get floated out with them, as is so often the case in Melbourne, down the surface-drains (there being no other drains there any more than there are here in Brisbane), then the "volatile-organic-matter" nuisance proclaims itself very loudly. The ashes, again, amongst which are the kitchen offal and waste—always excepting "gone meat" —do not give off any "volatile organic matter" to speak of, provided always the scullery-maid does not seek to convert them into the reeking ooze so familiar to the cleaners of "Manchester middens"; and they and the stable litter, which are generally associated, can be got rid of even in the daytime without causing any very violent shock to the sense of smell. But to hide, remove, and bury the ordure, what infinite shifts has unhappy man not been put to? To enumerate a few of the methods which have from time to time been adopted to get rid of the fœcal emanations about towns and buildings, I might mention the ordinary privy with its oozing cesspool, periodically emptied by the nightman; and who, I wonder, has not experienced the horrors of the disgusting process? The modern water-closet is another method which, so far as the individual house in which it is established is concerned, is the best that has obtained hitherto; but when the wide-spread evils attendant on this system, through the necessary underground drains which convey the contents away from the closets debouching into the tidal and other streams round about, is taken into consideration, the water-closet is anything but an unmixed benefit. As before remarked, the dangerous "volatile organic matter" is only indefinitely increased in proportion to the largeness of the volume of moist, fœtid, putrefying matter, and which the water-closet system only augments to the detriment of whole populations.

So much alive are the chemists and sanitary reformers to the baneful influences of accumulations of alvine excrementitious matters, and so well aware of the inefficacy of the ordinary systems of underground drainage to abate the evils that arise from them, that they have from time to time adopted schemes for deodorizing and utilizing sewage matters, backed by the strongest scientific evidence and, rendered attractive by prospects of profit as the most powerful of arguments with a world bent on the acquisition of "filthy lucre." They have invented all manner of disinfectants to render innocuous the emanations and evaporations from the foulness arising from the necessities of man. They have tried to kill the gases by charcoal and other filters, and, at other times, to carry them high into the air by large ventilating shafts—"smelling-bottles" as they are sometimes called. Again, they have attempted to intercept the drains by series of tanks, hoping to catch the solid matters and let the liquid free. This particular scheme was prosecuted with zeal by no less a personage than the late Prince Consort in draining Windsor Castle, so intolerable and unbearable had that royal mansion become to Imperial nerves; and, as far as I have been able to ascertain from reading and observation, this plan will prove the safest and cheapest, and even a profitable one. It is worthy of remark that any such system is only rendered necessary by the modern water-closet, as the quantity of water necessary for a thorough flushing must have an escape, for no cesspool would long absorb the quantity of water and solid matter of the closet without frequent cleansing, or else produce the inevitable ooze from the surface,—anything but a "Pierian spring," unless in the solemn lessons it gives. The ordinary privy does not generally require draining unless rain water gets into it.

I would here mention another mode, which has been largely adopted in France and America, for disposing of night soil, but which is scarcely adapted to the wants contingent on the water-closet system. The mode I refer to is the pneumatic waggon for extracting silently and invisibly the contents of cesspits. I say it is scarcely adapted to the water-closet system, because it would be one continual emptying; but for ordinary privies, no modern invention has yet done so much to lessen the revolting abomination attendant on the functions of the nightman; and my surprise is that, with all the boasted advancement of learning on these matters in our time, it has not been universally adopted. The matter has not been lost sight of, for I find that Mr. Macfarlane, of Glasgow, read a paper before the Philosophical Society there in April, 1857, advocating this very system, but adapted to the existing system of drainage, which deserves the attention of every one who wishes to preserve the air he breathes pure and wholesome.

Now, having given a very cursory outline of the various methods of disposing of sewage matters, it remains to say what I can on some

of the advantages of the earth closet as a means of preventing the vitiation of the atmosphere. I should like it to be clearly understood that certain circumstances are to be taken into consideration before the earth-closet admits of discussion as a sanitary appliance. First of all, we may suppose a place totally without underground drainage, as are Melbourne and Brisbane, and with nothing but the ordinary cesspool accommodation. Then, again, in a place like Brisbane, where the heat is so great in the summer months at a time when there are copious falls of rain, which fill up cesspits—often mere holes dug a foot or two deep—causing those reeking rills of odoriferous ooze so disgustingly familiar at every turn, and the great difficulty and enormous expense attendant on emptying them—in fact, the impossibility often of even getting anyone to do the work—are potent reasons for considering whether or not some sort of contrivance like the earth-closet may not eventually come into use. In Melbourne I know from personal inspection and converse with those interested in these matters that they are most anxious to introduce by force of law the earth-closet system, so convinced are they of its adaptability to their wants. The earth closet seems to be based on the most natural principles, for we see cats and dogs, and animals which are jealous of their presence being detected by their natural enemies, burying their droppings to destroy all trace of smell. And the law of the ancient Israelite was clearly based on natural principles; he was required "to have a place without the camp whither thou shalt go forth abroad; and thou shalt have a paddle upon thy weapon; and it shall be when thou wilt ease thyself abroad, thou shalt dig therewith and shalt turn back and cover that which cometh from thee."—Deut. xxiii, 13,14. It seems that the Rev. Mr. Moule, vicar of Fordington, Dorset, is the inventor of the Earth Closet, and, like all enthusiasts, he rides his hobby too much; yet he has not succeeded in converting the sanitary reformers to his way of thinking on the subject, although he has written and agitated much from first to last. Some remarks were made in a paper on "Hospitals," recently read before this society, condemnatory of earth closets, and the *Builder* was quoted in support of such condemnation. But certainly the whole of the *Builder's* opinion was not quoted, otherwise I should not have found the following remarks on the Rev. Mr. Moule's closets in an old volume of that periodical. After speaking of the improvements made in Mr. Moule's patent earth-closets, such as his having made one self-acting and another with an arrangement for transferring the soil to a shaft or receptacle, the writer of the notice goes on to say—"The dry earth-closets must be a decided improvement in rural districts, where there are not even decent cesspools, far less drainage; but we cannot agree with the reverend inventor that it ought to take the place of drainage in towns, far less in London—even to which he appears to desire its introduction. Did he ever estimate the quantity of dry earth per annum with which it would be requisite to supply the metropolis, or even any large town, on his system? It is not on this account, however, that we object to such a system in towns. Were the theoretical operation of his closets to be always depended on in practice, including perpetual and universal care and attention as to the supply of earth, thorough deodorization and other circumstances, the offence to sense and health *might* not be very great; but the reverend inventor does not seem to make sufficient allowance for inevitable wide-spread and perpetually-recurring neglect, indolence, recklessness, and ignorance, which would to a certainty render his system one of the most abominable town nuisances in existence—worse even than cesspools." It appears to me that the writer just quoted did not take the trouble to test the operation of the earth-closet—if the Rev. Mr. Moule's self-acting one was really practicable, for as to its mechanism I am quite ignorant, and the *Builder* does not enlighten us thereon;—for had he thoroughly and fairly tested the closet, I doubt not his prophecy as to the inevitable neglect would have been somewhat modified. I must confess that for a long time my prejudices quite coincided with those just mentioned, and I came to the conclusion that unless a cheap, simple, self-acting apparatus could be constructed, that the dry-earth closet must only remain a thing of the imagination—the mere hobby of a country parson; but a variety of circumstances conspired to stimulate me to endeavour to plan such an apparatus, for the use of such places as hospitals, gaols, and lunatic asylums, where some officer would always be available for the duty of attending to them daily. I purpose to detail the steps I took in perfecting the apparatus; but before doing so, I would mention that besides the Rev. Mr. Moule, many other persons have directed their attention to the subject, amongst whom are Messrs. G. Smith and Co., of Glasgow, who patented a closet "which pours out sawdust from a perforated box every time the lid is closed." I have a sample of their closet in my possession, which is called a "patent earth-closet", but it won't work with soil or sand. I never tried it with sawdust; but how could any town get supplied with sawdust for such a purpose?

A Mr. Owen, of Manchester, made use of disinfecting powder in a similar apparatus, so also did Mesers. Muir and Carrick; but Dr. Lloyd, of Anglesea, prefers charcoal in his dry closet. Messrs. Macfarlane, of Glasgow, have also several patent dry closets, and I have no doubt there are many others in existence,

the knowledge of which I am not in possession of.

The idea I set out with was, that if I could, by any possibility, plan a thing that would require no more attention than the bedroom slops, it would be a success if not a source of public profit. But the nature of dry earth —which, nevertheless, has some very faint characteristics of a fluid, for it will find its own level, as every little urchin knows who makes dust and mud pies—was *the* obstacle in constructing any machine, for I found it wedged itself up tight in the first contrivance I attempted, as it had done in Smith's closet, and then stones got in and nearly destroyed the whole concern. Observing that when the earth or sand flowed through an orifice into a vessel or on to a bit of board placed close underneath it, only a certain quantity would run until the material found its own level or slope, which seemed to be about 3 to 1. Then to proportion a vessel—a pan or scoop—of the capacity required for one operation, which would overturn its contents at the right moment and cut off the supply at the same time, was the work of a great number of experiments; but I succeeded at last and made the seats by a drop of less than two inches work the pan with the greatest ease, and nothing disturbed it for nearly a fortnight, when in daily use by some fifteen or twenty workmen, until by some accident a piece of stone, about two inches long, one and a half inches wide, and nearly an inch thick, got into the hopper and broke the temporary wooden scoop off its axle. This accident led to the adoption of a riddle over the hopper to prevent the introduction of such impediments in future. I produce a sketch showing the construction, as the best means of making the matter clear. It is so simple that a child can use the closet, and is not more trouble to keep in order than the wash-hand basin in one's bedroom; and as to anything unpleasant either to the sight or smell, I never found it out, although, as before remarked, some fifteen or twenty workmen used the closet for some days, a labourer supplying a bucket of dry earth in the morning and taking the full one away, which was which it being difficult to distinguish. I shall be pardoned for going into such detail on this subject after what I have advanced in the former part of this paper as to the direful consequences of vitiated air, particularly in hot climates. I had not intended to read this paper until the closet just described had been tested in some public institution. It is now in the hands of the surgeon of the Brisbane Hospital, for that purpose, who promises to give it a fair trial.

To point out one or two of the practical results that might arise, if by any means some municipal regulations could be enforced, and a rate levied for the general adoption of the dry earth system, in Brisbane. There is little or no drainage here—that is, underground drainage—and there is not likely to be any for some time to come. When any system of drainage is carried out the cost will be enormous, say roughly half a million of money—(the new drainage of London will cost £4,100,000)—for North and South Brisbane and Fortitude Valley. Then there would be the evil of running the sewerage matter into the tidal river, to be sent oscillating back and forward until some flood swept it into the Bay. Half a million would not take the sewers to the bay. The surface drainage from slopsinks, urinals, and so forth, having plenty of waste Enoggera water to dilute it with now, would not affect the river; but should the contents of cesspools or water-closets without drains find their way into the street channels, as sometimes happens in Melbourne, we must bid good-bye to a healthy town before long. Hence, in the first place, the adoption of the dry-earth system would at once prevent the outlay of an immense sum of money, not to mention the saving it would effect by keeping the people in health. Supposing the contractor for the town scavenging under such a system were required by municipal bye-law to have two carts, one with dry loam, the other to receive the contents of the closets, he could leave a bucket of fresh earth daily as he took the other away, which would be little more labour than is required of the dustman in scores of large towns in Great Britain and in America. The price the scavenger would get for his load of stuff would be a source of profit, if anyone could be found wise enough to apply it to a farm, and of that there is no doubt whatever. (See an article in the *Adelaide Observer* for an earnest of this.) I believe it is now conceded that earth is the best deodorizer, and the best disinfectant as well; hence if it be applied in the ready manner indicated, it at once nips the evil of bad drainage and bad air in the bud by preventing it altogether.

I have to state, in conclusion, with reference to the closet I have had made, that any dry material such as loam, dry earth, sand, lime, core, ashes, sawdust or sweepings may be used with equal advantage as far as deodorizing, or even the commercial value of the product is concerned; so that there can be no difficulty experienced in procuring a supply of suitable material, as the housemaid might use the hopper as a receptacle for ashes and dust. The cost of such a closet would not exceed £3, and it cannot be disarranged by use.

The most recent confirmation of the success of the earth-closet system is that of Dr. Faucus, at a large gaol at Alipore, near Calcutta, which a writer in the *Builder* says "ought to lead to great practical results."

Printed at the "Guardian Office," Brisbane.

THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

(From the *Queensland Guardian*, November 24, 1866.)

POISONOUS ANIMALS.

The following paper was read before the Philosophical Society, by Dr. Bancroft, at its meeting on Monday, November 19, 1866:—

There are many interesting facts that deserve further investigation respecting the poisonous effects produced by noxious animals found in this country. I select for description the common "tick," which abounds in some parts of the thickly wooded districts—the scrubs. It belongs to the Arachnida or spider class,—to which, also, belong scorpions, spiders, mites, the human itch insect, the scab insect of the sheep, and many other poisonous creatures.

The ticks that live on the dog and sheep in Europe crawl upon those animals when in the woods; they are not destructive to life, but the one here described is to our introduced animals very poisonous, and the dog and cat are frequently killed by it. The tick varies in size from the smallest point to a quarter of an inch, and when distended with blood is often half-an-inch long, and nearly of the shape of a castor oil seed. From this resemblance the castor oil seed was called by the Romans *Ricinus* (Eng. tick), and the castor oil plant is now called *Ricinus communis*.

The ticks are found on men and animals after walking through the scrubs, and in some parts they abound to such an extent that it becomes a serious matter to remain in their strongholds. Contact with an animal of large size is an event in the life of a tick not to be disregarded. Its carniverous propensities now come into vigorous action; in a short time it penetrates the skin, sacrificing its powers of locomotion to enjoy a continuous feast on the blood of its victim.

The tick generally seizes upon the soft folds of the skin — about the neck and ears of dogs, and in men, about the neck, groin, and armpit. In attaching themselves to the skin, they produce little pain, and are rarely noticed; but shortly afterwards a small inflamed point results, which the uninformed mistake for a small boil.

Persons familiar with the tick can tell by the peculiarity of the pain when the inflamed point is touched that he is suffering from a tick bite. He then seizes the tick between his nails, and plucks it off.

How so small an insect can attach itself with such force to the skin is understood by referring to the microscopic structure of its back.

The beak, or penetrating organ, is a fiftieth of an inch long, and consists of two outer valves which form its sheath. The central body is conical, and covered with minute barbules pointing backwards—all arranged in rows of about twelve, and of these rows there are six; so on this small organ we find upwards of seventy barbules. Applied to the sides of the penetrator are two finer instruments without barbules except at their points, where there are five. These organs I consider assist in penetration, by attaching themselves in the first instance so that the tick then has some support by which he can press forward the central penetrator.

The feet are not a little curious and consist of an oval elastic pad, to the margin of which we find two fine hooklets. By means of the barbules on the penetrator, the attachment becomes more or less permanent, and it would appear that the tick, once adherent cannot disconnect itself. That circumstance would probably occur in some instances by ulceration of the structure into which the tick had pene-

trated, but to the native animals, as for instance the iguana, the attachment is of long duration and does not appear to be injurious. A part of the penetrator is always left behind when a tick is forcibly pulled out.

A popular idea is that the tick burrows through and lives underneath the skin, and though that is the case with some arachnida—as the itch insect—it is not so with the tick. Swelling of the surrounding tissues, however, may—as in the armpit, nearly bury the tick.

A bandicoot once shot by me, was directed to be skinned; ticks were found on its skin, and I was told, under it also. The underlying ones on examination were found to be metallic.

In a short time after the attachment of a tick some slight pain and swelling results, which is often neglected. The tick fills with blood, and the pain increases, until in the human subject it becomes so severe as to attract notice. A few days ago I removed one from a gentleman that had been attached a fortnight. It was half-an-inch long, and had caused considerable pain and swelling of the neck, together with a sense of debility.

The results upon the dog and cat are more serious and demand particular notice. All dogs that have been bitten in the scrubs are very liable to be attached by ticks, especially if they have long hair. If these are not removed in the course of three or four days death may be expected. They may be felt attached to the skin about the neck and other parts the dog cannot reach with his teeth. All dogs, large or small, should be carefully combed and watched for several days, to see if tick-poisoning present itself. I have never seen pups recover after this has appeared. In full grown strong dogs the following symptoms present themselves. In two or three days after the attachtachment of a tick, the dog begins to look weary. The cat in addition by not washing itself appears dirty. Food is refused and soon after, drink. The animal lies down, and seeks for that purpose some place where he can remain undisturbed. Pups travel away and are rarely again found alive. The dog responds to the call of his master, but will not follow him far; shortly weakness in the hind legs is observed, and in about five days from the attachment of the tick the animal becomes unable to walk, and may at times be seen to be timid and delirious. On attempting to rise up on his fore-feet he may fall over insensible—in a few minutes he recovers his consciousness. On observing closely one of these attacks, it will be seen that the lips of the dog are pale, his heart can scarcely be felt to beat, and the condition of fainting is clearly noticeable. During all his illness there is the greatest reluctance to take food or drink, and forcible feeding brings on his fainting attacks. He tries to creep out of sight by the help of his fore-legs, and in a few days at the farthest dies in one of the attacks. Old dogs endure much longer than pups, and if the tick has been removed early, recovery may be hoped for.

The only cat I have seen suffer lay unable to walk for a week. She was forcibly fed with milk during the time, and made a slow recovery. Cats are said to have nine lives.

The action of the tick poison I consider to be similar to that of the snake. The poison, however, produces its effects more slowly and is also more slowly got rid of by the excretions.

The cause of death appears to be chiefly if not entirely from muscular paralysis, produced by a poisoned condition of the fluids. Those muscles most remote from the centre of circulation and which receive the least supply of blood suffering most from the paralysis. The hind legs are the first to lose their power, the fore legs next, and lastly the heart. Death taking place from want of the power of contraction in that organ.

Printed at the "Guardian Office," Brisbane.

THE

ANNUAL REPORT

OF THE

QUEENSLAND PHILOSOPHICAL SOCIETY

1866.

WITH

THE PRESIDENT'S ADDRESS.

BRISBANE:
PRINTED BY W. C. BELBRIDGE AND CO., "GUARDIAN" OFFICE.

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QUEENSLAND

PHILOSOPHICAL SOCIETY.

ANNUAL MEETING, HELD ON MONDAY, DECEMBER 31, 1866.

(From the *Queensland Daily Guardian*, January 2, and January 5, 1867.)

The annual meeting of the Queensland Philosophical Society was held in the Town Hall on Monday, 31st December, 1866, Chief Justice Cockle, F.R.S., the President, in the chair.

After the minutes of the last meeting had been read and confirmed, the Secretary laid on the table a present of copper coins for the museum, from Mr. Charies Carrington, and it was ordered that the present be acknowledged with thanks.

Mr. PETTIGREW gave notice that at the next meeting he should move the reconsideration of the day fixed for holding the monthly meeting.

The report of the council on the state of the Society and its proceedings during the year, was then read by the Secretary and adopted.

REPORT.

"According to custom, the council have pleasure in laying before the members of the Society a report of their proceedings during the past year, and in doing so they feel that they have enjoyed as large a share of the time and attention of the members as could be expected, when the anxieties caused by commercial troubles are taken account of, most of our members being actively engaged in commercial pursuits, and consequently only able to devote their *leisure hours* to scientific inquiry.

"The number of the members continues the same as last year, and the state of the finances will be seen by reeference to the treasurer's statement.

"The following papers have been read at the monthly meetings :—

"26th March.—On Neglected Vegetable Products ; by Mr. W. P. Townson.

"30th April.—On the Fundamental Principles of Hydrostatics ; by Chief Justice Cockle, F.R.S.

"28th May.—On Some of the Customs and Superstitions of the Aboriginal Tribe, known as Kommilaroy ; by Mr. C. Coxen.

"25th June.—On the Form and Construction of Hospitals ; by Mr. R. G. Suter.

"30th July.—On the Inverse Problem of Co-resolvents ; by Chief Justice Cockle, F.R.S. Supplementary paper, on the Form and Construction of Hospitals ; by Mr. R. G. Suter.

"27th August.—On the Use of Earth Ciosets ; by Mr. C. Tiffin.

"19th November.—On Poisonous Insects ; by Dr. Bancroft.

"It will be noticed that most of the papers (as in past years) have a direct reference to the settlement of a European population on the Australian soil, and the adaptability of European inventions to our present circumstances ; such is particularly the case with the papers read by Messrs. Townson, Suter and Tiffin ; whilst Mr. Coxen's paper has the merit of placing on record his personal knowledge and experience regarding an Aboriginal Tribe now almost passed away. Contributions to the science of mathematics are found in the papers read by the President.

"The Council have to record further contributions towards the Museum :—Shells and fossils from Gowrie Creek, from Mr. J. K. Handy ; aërolites, from the Rev. E. Tanner ; shells and native implements, from Mr. M'Clintock ; ancient coins, from Mr. C. Carrington ; and a small parcel of tho fossil remaius of a saurian turtle has been forwarded to Professor Owen, of London, by Mr. E. W. Lambe, thrnugh the society.

"It has now become a matter of pressing

importance to provide a more suitable place for the preservation of the property of the Society, as the cases in the Windmill have suffered considerably during the late heavy rains; happily but little damage has at present been done, but unless some precautions are taken, we can hardly hope to escape much longer.

"The library is now open for the use of members, and a few scientific periodicals are received by every mail.

"The Council has again to acknowledge with thanks the kindness of the Mayor and Corporation of Brisbane in allowing the Society the use of the room in which the meetings are held, and for permission to place therein a case containing the books belonging to the Society.

"In conclusion, the Council cannot look back upon the past year otherwise than as one of fair success; and they trust that members will endeavour to provide a paper for each evening of meeting, as they afford the greatest amount of interest, if bearing the stamp of careful thought or original observation.

"John Bliss,
"Honorary Secretary."

After the adoption of the Report, the President delivered the following

ADDRESS.

Since our last annual meeting there has been a meeting (the thirty-sixth) of the British Association for the Advancement of Science, that great assembly of scientific notables in which the latest advances of knowledge are discussed, and in the annual Reports of which the successive states of the sciences at given epochs are recorded and criticised. The address of the President for the current year, Mr. Grove, Q.C., is an important and interesting one, and my purpose is to lay an abstract of it before you, followed by some remarks arising out of it. Mr. Grove says that in the study of our own planet and the organic beings with which it is crowded, and in so much of the universe as vision, aided by the telescope, has brought within the scope of observation, the present century has surpassed any antecedent period of equal duration; that to the more practical minds the reality, the certainty, and the progressive character of the acquisitions of natural science, and the enormously increased means which its applications give, have impressed its importance as a minister to daily wants, and a contributor to ever increasing material comforts, luxury, and power; that an important cause of the rapid advance of science is the growth of associations for promoting the progress either of physical knowledge generally, or of special branches of it. Then, after pointing out the advantages conferred by such societies, the President says that every votary of physical science must be anxious to see it recognised by those institutions of the country which can to the greatest degree promote its cultivation and reap from it the greatest benefit; that the principal educational establishments on the one hand, and on the other the Government, in many of its departments, are the institutions which may best fulfil these conditions; that little can be achieved in scientific research without an acquaintance with it in youth, and that, while he would never wish to see the study of languages, of history, of all those refined associations which the past has transmitted to us, neglected, still that there is room both for those studies and the study of the sciences; and he expressed a hope that the slight infiltration of scientific studies, now happily commenced, will extend till it occupies its fair space in the education of the young; and that those who may be able learnedly to discourse on the Æolic digamma, will not be ashamed of knowing the principles of an air-pump, an electrical machine, or a telescope, and will not, as Bacon complained of his contemporaries, despise such knowledge as something mean and mechanical. "To assert," says Mr. Grove, "that the great departments of Government should encourage physical science, may appear a truism, and yet it is but of late that it has been seriously done; now, the habit of consulting men of science on important questions of national interest, is becoming a recognised practice." And in a time which may seem long to individuals, but is short in the history of a nation, a more definite sphere of usefulness will, he has no doubt, be provided for those duly qualified men who may be content to give up the more tempting study of abstract science for that of its practical applications. The President then submits certain views of what has, within a comparatively recent period, been accomplished by science; what have been the steps leading to the attained results, and what, as far as an opinion may fairly be formed, is the general character pervading modern discovery. He thinks that each President may properly enounce his own view of the general progress of science, and that the confining him to a mere *résumé* of what has taken place since a previous meeting, would limit his means of usefulness, and render his discourse rather an annual register than an instructive essay. Mr. Grove then gives, as the key to his discourse, the word "Continuity," and the idea that all knowledge is either attained by steps so extremely small as to form really a continuous ascent; or, when distinct results, apparently isolated, have been obtained, that then, by the subsequent progress of science, intermediate links have been discovered uniting the apparently segregated instances with other more familiar phenomena; that in existing phenomena, graduation from the like to the seemingly unlike prevails; and in the changes which take place in time, gradual progress is, and apparently must be, the course of nature. He then applies his view to the recent progress

of some of the more prominent branches of science. Thus, double stars seem to be orbs analogous to our own sun, revolving round their common centre of gravity, in such a manner as that gravitation would appear not to be limited to the Solar System, but to extend to such systems of stars. Doubt, indeed, has been expressed whether gravitation acts with the nebulæ—at least those of a spiral form—as it does with us; possibly some other modifying influence may exist, our ignorance of which gives rise to the doubt. Again, there is evidence, almost amounting to proof, that meteors or shooting stars are cosmical bodies, moving in the interplanetary space by gravitation round the sun, and some, perhaps, round planets. This view gives us a new element of continuity. The universe would thus appear not to have the extent of empty space formerly attributed to it, but to be studded between the larger and more visible masses with smaller planets, if the term be permitted to be applied to meteorites. Further, the number of known asteroids, or bodies of a smaller size than what are termed the ancient planets, has been so increased by numerous discoveries that, instead of seven, we now count eighty-eight as the number of recognised planets, the smallest of which is only three or four miles in diameter. Were we to apply the same scrutiny to other parts of the heavens, as has been applied to the zone between Mars and Jupiter, it is no far-fetched speculation to suppose that, between these asteroids and the meteorites, bodies of intermediate size exist until the space occupied by our Solar System becomes filled with planetary bodies, varying in size from that of Jupiter (1240 times larger in volume than the earth), to that of a cannon ball or even a pistol bullet. According to M. Daubrée, the similarity of terrestrial rocks to meteorites increases as we penetrate deeper into the earth's crust, and some of the deep-seated minerals have a composition and characteristics almost identical with meteorites; and, by experiments, he has succeeded in forming, from terrestrial rocks, substances very much resembling meteorites. Thus close relationship, though by no means identity, is established between this earth and those wanderers from remote regions; some evidence, though at present incomplete, of a common origin. Mr. Grove adds that it has long seemed to him that there is no ground for wonder that, while the mean specific gravity of this globe is from five to six times that of water, that of its crust is barely half as great. The exterior is to a considerable depth oxidated; the interior is, in all probability free from oxygen, and whatever bodies exist, there, are in a reduced or deoxidated state—if so, their specific gravity must necessarily be higher than that of their oxides, chlorides, &c. Next, optical science aids us in inquiring into the relation of our planet in composition to other planets, to the sun, and to more distant suns and systems. Light, passing from one transparent medium to another, carries with it evidence of the source from which it emanates, and, probably (could we read it) everything contains in itself a large portion of its own history. The spectrum analysis seems to show that, while comparatively neighbouring cosmical bodies exhibit lines identical with those shown by the components of this planet, as we proceed to the more distant appearance of the nebulæ we get but one or two of such lines, and we get one or two new bands not yet identified with any known to be produced by substances on this globe. The position in the spectrum of the bright line furnished by the nucleus of the comet 1 of 1866 is the same as that of nitrogen, which is also shown in some of the nebulæ, but its coma or tail, appeared to be in a condition analogous to that of fog or cloud. The temporary star which shone forth this year in the constellation of the Northern Crown gave a spectrum alleged to be unlike that of any celestial body before examined. One of its spectra was analogous to that of the sun. The second indicated that the light was emitted by luminous gas, probably hydrogen at a very high temperature and burnt with some other element, and that by the resulting temperature the photosphere was heated to incandescence. It would seem as if the phenomenon of gradual change obtained towards the remotest of known objects, and that the further we penetrate into space the more unlike to those with which we are acquainted become the objects of our examination. Whether the moon has even a minute atmosphere, and whether certain portions of her surface are indicative of igneous fusion or of diluvial formation, are points on which at present no positive opinion can be pronounced. There seems to be room for a substantial improvement in the construction of the achromatic telescope. Passing on to the subject of, what are sometimes called, the imponderables, Mr. Grove says that magnetism and electricity are forces so universal, so apparently connected with matter as to become two of its invariable attributes, and so with light, heat, and chemical affinity. It seems to him that it is now proved that all these forces are so invariably connected with each other and with motion, as to be regarded as modifications of each other, and as resolving themselves objectively into motion, and subjectively into that something which produces or resists motion, and which we call force. Magnetism, then, must be cosmical and not merely terrestrial; and to trace it in other planets and suns as a force manifested in axial or meridional lines would be a great, but it is a hitherto unaccomplished, step. Mr. Grove then observes that one of the most startling suggestions as to the consequence resulting from the dynamical theory of heat is that made by Mayer, that by the loss of *vis viva* occa-

sioned by friction of the tidal waves, as well as by their forming, as it were, a drag upon the earth's rotatory movement, the velocity of the earth's rotation must be gradually diminishing, and that thus unless some undiscovered compensatory action exist, its rotation must ultimately cease, and changes hardly calculable take place in the solar system. He adds, that M. Delaunay considers that part of the acceleration of the moon's mean motion, which is not at present accounted for by planetary disturbances, to be due to the gradual retardation of the earth's rotation; to which view, after an elaborate investigation, the Astronomer Royal has given his assent. There are some difficulties, not perhaps insuperable, in another speculation of Mayer, viz., that the heat of the sun is occasioned by friction or percussion of meteorites falling upon it. Then, after pointing out that, enquiry may arise as to what becomes of the light and heat radiated into space, the President passes on to molecular physics, in which field the doctrine of correlation of forces is steadily making its way. In a practical point of view, the power of converting one mode of force into another is of the highest importance; and with reference to a subject which at present—prematurely, perhaps—occupies men's minds, viz., the prospective exhaustion of the coal-fields of England, there is every encouragement derivable from the knowledge, that we can at will produce heat by the expenditure of other forces; but, more than that, we may probably be able to absorb or store up, as it were, diffused energy. The example of formate of potash, and others similar, may calm apprehension as to future means of supplying heat, should our present fuel become exhausted. As the sun's force, spent in times long past, is now returned to us from the coal which was formed from that light and heat, so the sun's rays, which are daily wasted, as far as we are concerned, on the sandy deserts of Africa, may hereafter, by chemical or mechanical means, be made to light and warm the habitations of the denizens of colder regions. The tidal wave is, again, a large reservoir of force hitherto almost unused. The researches of Tyndall afford instances of localising, if the term be permitted, heat which would otherwise be dissipated; and those of Graham afford indications of means of storing up force. We are at present far from seeing a practical mode of replacing those granaries of force—coal-fields; but we may with confidence rely on invention being in this case, as in others, born of necessity, when the necessity arises. There hardly seems a limit to the extent to which mechanical may be converted into electrical force. As we may, in a not very distant future, need, for the daily uses of mankind, heat, light, and mechanical force, and find our present resources exhausted, the more we can invent new modes of conversion of forces, the more prospect we have of practically supplying such want. Mr. Grove then passes on to physiology, in which considerable strides are being made by studying the relation of organized bodies to external forces. Vegetables, acted on by light and heat, produce certain chemical changes. The animal reverses the process; but it must not be forgotten that the line of demarcation between a vegetable and an animal is difficult to draw,—that there are no single attributes which are peculiar to either—and that it is only by a number of characteristics that either can be defined. That musular action is produced or supported by chemical change would probably now be a generally-accepted doctrine; but recent researches seem to show that the oxidation of albuminous or nitrogenized substances is rather an accompaniment than a cause of muscular force, and that it is by the oxidation of carbon and hydrogen that such force is supplied. We must not confuse the question of the food which gives permanent capability of muscular force, with that which supplies its requisites of temporary activity. Some of the graminivora have great capacity for temporary exertion, but for concentrated and sustained energy they do not equal the carnivora. And the domestic graminivora are capable of performing more work when supplied with those vegetables which contain the greatest quantity of nitrogen. Mr. Grove believes the day is approaching when inventions of entities made to vary according to the requirements of the theorist will be dispensed with, and when the two fundamental conceptions of matter and motion will be found sufficient to explain physical phenomena. He considers that geology affords striking evidence of continuity, and that the breaks in the record do not represent sudden changes in the formation of the earth's crust, but rather arise from dislocations occasioned since the original deposition of strata, or from gradual shifting of the areas of submergence. Then comes the question whether, when the geological formation is continuous, the different characters of the fossils represent absolutely permanent varieties, or may be explained by gradual modifying changes. The physical breaks in the stratification make it next to impossible to fairly trace the order of succession of organisms by the evidence afforded by their fossil remains, but many geologists seem to believe that the succession of species bears some relation to the succession of strata. Indications, too, of the connection between cosmical studies and geological researches are dawning on us, and Mr. Grove, like Sir J. Herschel, seems impressed with the magnificence of that view of geological revolutions which regards them rather as regular and necessary efforts of great and general causes, than as resulting from a series of convulsions and catastrophes

regulated by no laws and reducible to no fixed principles. Thus, Mr. Croll argues that if the extremes of heat and cold in winter and summer be greater, a colder climate will prevail, for there will be more snow and ice accumulated in the cold winter than the hot summer can melt, a result produced by the vapour (aided by the shelter from the sun's rays) suspended in consequence of the aqueous evaporation; hence we should get glacial periods, when the orbit of the earth is at its greatest eccentricity at those parts of the earth's surface where it is winter when the earth is in aphelion; carboniferous or hot periods, where it is winter in perihelion; and normal or temperate periods, when the excentricity of orbit is at a minimum; all these would gradually slide into each other, and produce at long distant periods alternations of cold and heat, several of which we actually observe in geological records. Mr. Caroll's computation would make it certainly not less than 100,000 years since the last glacial epoch, probably it is much more. In the old theories the apparent changes on the earth's surface were accounted for by convulsions and cataclysms; the referring past changes to causes similar to those now in operation remained uninvestigated until the present century. It is much more easy to invent a special cause than to trace out the influence of slow continuous change; the love of the marvellous is so much more attractive than the patient investigation of truth, that we find it to have prevailed almost universally in the early stages of science. In geology a deluge or a volcano was supplied. In palœontology a new race was created whenever theory required it; how such new races began, the theorist did not stop inquire. A curious speculator might address to a palæonlologist of even recent date, words of Lucretius which Mr. Grove paraphrases thus: "You have abandoned the belief in one primæval creation at one point of time; you cannot assert that an elephant existed when the first Saurians roamed over earth and water. Without, then, in any way limiting Almighty power, if an elephant were created without progenitors, the first elephant must, in some way or other, have physically arrived on this earth. Whence did he come? Did he fall from the sky (*i.e.* from the interplanetary space)? Did he rise moulded out of a mass of amorphous earth or rock? Did he appear out of the cleft of a tree? If he had no antecedent progenitors, some such beginning must be assigned to him." Mr. Grove knows of no scientific writer who has, since the discoveries of geology have become familiar, ventured to present in intelligible terms any definite notion of how such an event could have occurred. Those who do not adopt some view of continuity are content to say, God willed it; but would it not be more reverent and more philosophical to inquire by observation and experiment, and to reason from induction and analogy, as to the probabilities of such frequent miraculous interventions? The President knows that he touches on delicate ground, and that a long time may elapse before that calm inquiry after truth which it is the object of scientific institutions to promote can be fully maintained; but he trusted that the members of the British Association are sufficiently free from prejudice, whatever their opinions may be, to admit an inquiry into the general question whether what we term species are and have been rigidly limited, and have at numerous periods been created complete and unchangeable, or whether, in some mode or other, they have not gradually and indefinitely varied, and whether the changes due to the influence of surrounding circumstances, to efforts to accommodate themselves to surrounding changes, to what is called natural selection, or to the necessity of yielding to superior force in the struggle for existence, as maintained by our illustrious countryman Darwin, have not so modified organisms as to enable them to exist under changed conditions. Mr. Grove puts forward no theory of his own, nor does he argue in support of any special theory, but having endeavoured to show how, as science advances, the continuity of natural phenomena becomes more apparent, he thinks it would be cowardice not to present some of the main arguments for and against continuity as applied to the history of organic beings. The question whether among the smallest and apparently the most elementary forms of organic life, spontaneous generation obtains, has recently formed the subject of experiment and discussion in France. Although we see no such phenomenon as the formation of an animal such as an elephant, or a tree such as an oak, excepting from a parent which resembles it, yet, if the microscope revealed to us organisms, smaller but equally complex, so formed without having been reproduced, it would render it not improbable that such might have been the case with larger organic beings. The general opinion is, that when such precautions are taken as exclude from the substance submitted to experiment all possibility of germs from the atmosphere being introduced, as by passing the air which is to support the life of the animalculæ through tubes heated to redness and other precautions, no formation of organisms takes place. The question may not be finally determined, but the balance of experiment and opinion is against spontaneous generation. In proportion as our means of scrutiny become more searching, heterogeny, or the development of organisms without generation from parents of similar organism, has been gradually driven from higher to lower forms of life, so that if some apparent exceptions still exist, they are of the lowest and simplest forms; and these exceptions may probably be removed, if not removed already, by a more searching

investigation. If heterogeny obtains at all the result of the most careful experiments shows it to be confined to the most simple organic structures; and more highly developed forms are, as far as the most enlarged experience shows, generated by reproduction. The great difficulty which is met with at the threshold of inquiry into the orgin of species, is the definition; in fact, species can hardly be defined without begging the question in dispute. Unless the advocate of continuity can, on his side, prove the whole question in dispute by showing that all species can directly or by intermediate varieties reproduce, he is defeated by the definition itself of species. On the other hand, if it be admitted that distinct species can, under certain favourable conditions, produce intermediate offspring capable of reproduction, then continuity in some mode or other is admitted. The doctrine of gradual succession is hardly yet formularized; and though there are some high authorities for certain modifications of such view, the preponderance of authority would necessarily be on the other side. Geology and Palæontology are recent sciences, and we cannot tell what the older authors would have thought or written, had the more recently discovered facts been presented to their view. Authority, therefore, does not much help us on this question. Geological discoveries seemed, in the early period of the science, to show the complete extinction of certain species and the appearance of new ones, great gaps existing between the characteristics of the extinct and the new species. As science advanced, these were more or less filled up: the apparent difficulty of admitting unlimited modification of species would seem to have arisen from the comparison of the extreme ends of the scale, where the intermediate links or some of them were wanting. To suppose a Zoophyte the progenitor ef a Mammal, or to suppose at some particular period of time a highly developed animal to have come out of nothing, or suddenly to have grown out of inorganic matter, would appear at first sight equally extravagant hypotheses. As an effort of Almighty creative power, neither of these alternatives presents more difficulty than the other; but as we have no means of ascertaining how creative power worked, but by an examination and study of the works themselves, we are not likely to get either side proved by ocular demonstration. A single phase in the progress of transmutation would probably require a term far transcending all that embraced by historical records; and, on the other hand, it might be said, sudden creations, though taking place frequently, if viewed with refereuce to the immensity of time involved in geological periods, may be so rare with reference to our experience, and so difficult of clear authentication, that the non-observation of such instances cannot be regarded as absolute disproof of their possible occurrence. As undoubted cases of variation, more or less permanent, from given characteristics, are produced by the effects of climate, food, domestication, &c., the more species are increased byintercalation, the more the distinctions slide down towards those which are within the limits of such observed deviations; while, on the other hand, to suppose the more and more frequent occurrence of fresh creations out of amorphous matter is a multiplication of miracles, or special interventions, not in accordance with what we see of the uniform and gradual progress of nature either in the organic or inorganic world. The more we observe, the more we increase the subdivision of species, and consequently, the number of these supposed creations; so that new creations become innumerable, and yet of these we have no one well authenticated instance, and in no other observed operation of Nature have we seen this want of continuity—these frequent abrupt deviations from uniformity, each of which is a miracle. The difficulty of producing intermediate offspring from what are termed distinct species, and the infecundity in many instances of hybrids, are used as strong arguments against continuity of succession; on the other hand, it may be said, long-continued variation through countless generations has given rise to such differences of physical character, that reproduction is difficult in some cases, and in others impossible. Suppose, for instance, a parent race whose offspring by successive changes through ages of time have divaricated and produced two widely different species, the changes here have been so great that we should never expect directly to produce an intermediate between the two species. On the other hand each of these species might reproduce with two other species resembling either of them respectively, and resembling each other more nearly than the first mentioned two. Yet, to regain the original parent race or type, we must not only retrocede through all the intermediates, but must have similar circumstances recalled in an inverse order at each phase of retrogression, conditions which it is obviously impossible to fulfil. But, though among the higher forms of organic structure we cannot retrace the effects of time, and produce intermediate types, yet among some of the lower forms we find it difficult to assign any line of specific demarcation. Mr. Grove then adverts to some of the facts and authorities bearing on the derivate hypothesis, to the possible effects of climate and habits. If an animal seeks its food or safety by climbing trees, its claws will become more prehensile, the muscles which act upon those claws must become more developed, the body will become agile by the very exercise which is necessary to it, and each portion of the frame will mould itself to the wants of the animal by the effect on it of the habits of the animal. Another series of facts, says Mr.

Grove, which present an argument in favour of gradual succession are the phases of resemblance to inferior orders which the embryo passes through in its development, and the relations shown in what is termed the metamorphosis of plants; facts difficult to account for on the theory of frequent separate creations, but almost inevitable on that of gradual succession. So, also, the existence of of rudimentary and effete organs, which must either be referred to a freak of nature or to some mode of continuous succession. There would be a greater fixity in the organisms during periods of little change on the earth's surface than during periods of more rapid transition; for, though rejecting catastrophes as the general *modus operandi* of Nature, the President is far from saying that the march of physical change has been always perfectly uniform. While the evidence daily becomes stronger in favour of a derivative hypothesis as applied to the succession of organic beings, we are far removed from anything like a sufficient number of facts to show that, at all events within the existing geological periods capable of being investigated, there has been any great progression from a simpler or more embryonic to a more complex type. The records of life on the globe may have been destroyed by the fusion of the rocks, which would otherwise have preserved them, or by crystallization after hydrothermal action. The earlier forms may have existed when this planet was in course of formation, or being segregated or detached from other worlds or systems. We have not evidence enough to speculate on the subject, but by time and patience we may acquire it. But a small proportion of extinct forms is preserved. On the dry land, unwashed by rivers and seas, when an animal or plant dies it undergoes chemical decomposition which changes its form; it is consumed by insects, its skeleton is oxydized and crumbles into dust. In the deeper parts of the oceans, or of the larger lakes, the few fish there are perish and their remains sink to the bottom, and are there frequently consumed by other marine or lacustrine organisms, or chemically decomposed. As a general rule, it is only when the remains are silted up by marine, fluviatile, or lacustrine sediments that the remains are preserved. The mass of preserved relics would be those of creatures likely to inhabit deltas or the margins of seas, lakes, or rivers; and so we find it: the bulk of fossil remains consists of amphibia, shellfish form the greater part of the geological museum, limestone and chalk rocks frequently consisting of little else than fossil shells. Plants of reed or rush-like character, fish which are capable of inhabiting shallow waters, and saurian animals form another large portion of geological remains. Notwithstanding the immense number of preserved fossils, there must have lived an immeasurably larger number of unpreserved organic beings, so that the chance of filling up the missing links, except in occasional instances, is very slight. Yet, where circumstances have remained suitable, many closely connected species have been preserved—while the intermediate types in certain cases are lost, in others they exist. The opponents of continuity lay all stress on the lost, and none on the existing links. Let any one assume that one of his ancestors at the time of the Norman Conquest was a Moor, another a Celt, and a third a Laplander, and that these three were preserved while all the others were lost, he would never recognise either of them as his ancestor—he would only have the one hundred millionth of the blood of each of them, and as far as they were concerned, there would be no perceptible sign of identity of race. Taking intermarriages into account, the law of probabilities would indicate that any two people in the same European country, taken at hazard, would not have many generations to go back before they would come to a common ancestor, who probably, could they have seen him or her in the life, had no traceable resemblance to either of them. Thus, two animals of a very different form, and of what would be termed very different species, might have a common geological ancestor, and yet the skill of no comparative anatomist could trace the descent. The recent discoveries in palæontology show us that man existed on this planet at an epoch far anterior to that commonly assigned to him, and Mr. Grove thinks that what we call civilization must have been a gradual process. If he appears to lean to the view that the successive changes in organic beings do not take place by sudden leaps, it is, he believes, from no want of impartial feeling; but if the facts are stronger in favour of one theory than another, it would be an affectation of impartiality to make the balance appear equipoised. The prejudices of education, and associations with the past, are against the derivative hypothesis as against all new views, but, while a theory is not to be adopted because it is new and plausible, its running counter to existing opinions is not a reason for its rejection. The fair question is, does the newly proposed view remove more difficulties, require fewer assumptions, and present more consistency with observed facts than that which it seeks to supersede? if so the philosopher will adopt it, and the world will follow the philosopher—after many days. It must be borne in mind that, even if we are satisfied that organic forms have varied indefinitely in time, the ultimate cause of these changes is not explained by our researches. If it be admitted that we find no evidence of amorphous matter suddenly changed into complex structure, still, why matter should be endowed with the plasticity by which it slowly acquires modified structure is unexplained. If we assume that natural

selection, or the struggle for existence, gives rise to various organic changes, still we at present know not why like should produce like, why acquired characteristics in the parent should be produced in the offspring. Reproduction itself is still an enigma. We know not why organism should have this *nisus formativus*, or why the acquired habit or exceptional quality of the parent should reappear in the offspring. If we are satisfied that continuity is a law of nature, the true expression of the action of Almighty power, then we should cease to look for special interventions of creative power in changes which are difficult to understand, because, being removed from us in point of time, their concomitants are lost; we should endeavor from the relics to evoke their history, and when we find a gap not try to bridge it over by a miracle. Philosophy ought to have no likes or dislikes, truth is her only aim; but if a glow of admiration be permitted to a physical inquirer, "to my mind," says Mr. Grove, "a far more exquisite sense of the beautiful is conveyed by the orderly development, by the necessary inter-relation and inter-action of each element of the Cosmos, and by the conviction that a bullet falling to the ground changes the dynamical condition of the universe, than can be conveyed by mysteries, by convulsions, or by cataclysms." The sense of the understanding is to the educated more gratifying than the love of the marvellous, though the latter need never be wanting to the nature-seeker. This doctrine of continuity is not solely applicable to physical inquiries. Our language, our social institutions, our laws and constitution, are the growth of time, the product of slow adaptations arising from continuous struggles. Practical experience has taught us to improve rather than to re-model; we follow the law of nature, and avoid cataclysms. Whence, adds the President, does the conviction arise that each material form bears in itself the records of its past history? Is it not from this belief in continuity? As science advances our power of reading, this history improves and is extended. Saturn's ring may help us to a knowledge of how our solar system developed itself, for it as surely contains that history as the rock with its imbedded organisms contains the record of its own formation.

The above is, I hope, a tolerably correct condensation of the address delivered on the 22nd of August last, by the distinguished lawyer and philosopher to the brilliant assembly which thronged around him at the New Theatre, Nottingham. This society will not now expect or desire from me minute commentaries on an address which, if it does not contain a proof, still less a demonstration, of the hypothesis of continuity, at all events does contain striking illustrations of the hypothesis, drawn from great and varied sources of knowledge. The question arises whether the supposed continuity extends to the organic world, and whether organism exist on the planetary bodies. The conjectures, founded on analogy, which have arisen on this subject do not seem to have secured the universal assent of the authorities, nor has the telescope, or the spectrum analysis, as yet decided the question. Is any other species of evidence attainable, and may the meteorites possibly be the bearers of information respecting the organisms of worlds from which they have been severed? A meteorite which fell near Alais, in France, on March 15, 1806, was examined by Berzelius in 1834. He found it remarkable as containing an organic carbon compound, soluble in water, which turned brown on heating, deposited a black carbonaceous mass, and burned without residue. In 1860, Wöhler discovered traces of a crystallizable hydro-carbon, soluble in alcohol and ether, in two meteorites, one of which fell at Kaba, in Hungary, on April 15, 1857, and the other at Bokkevelde, in South Africa, on October 13, 1838. The fact, thus undoubtedly proved, of the existence in these two meteorites of crystallizable carbon compounds, which in terrestrial matter are solely the results of vital action, rendered a further confirmation of the existence of organic matter in the Alais meteorite of special interest, and accordingly Professor Roscoe, I suppose in 1862 or 1863, experimented upon a fragment of it which Mr. Greg, of Manchester, placed him in possession of. He found that the Alais meteorite contains at least a half per cent. of a crystallizable hydrocarbon. A remark of Professor Roscoe seems to render it doubtful whether the hydrocarbon was an organic product. To judge by the melting point it may be analogous to a mineral wax called könlite. Not having been able to refer to Sir David Brewster's observations, made many years ago, on the substances to be detected in crystals, I am at present unable to say whether they would favor the notion that the hydro-carbon in question is a mineral product. The mere fact of the hydro-carbon permeating the meteorite would not perhaps be conclusive against its being an organic product. At the launching of the Great Eastern, water is said to have been forced, undecomposed, through a considerable thickness of iron, and the sort of exudation which takes place on the exterior of large guns, after a certain amount of firing, may afford another illustration of the mode in which one substance may be forced into another, without suffering decomposition, by a certain amount of pressure or heat. It is to be remarked that the Alais meteorite was not coated with the ordinary black pellicle, but a white efflorescence, which covered the surface, consisted mainly of sulphate of magnesium. It is also to be noticed, that the conditions under which meteorites fall are not invariable. A meteorite fell on the

14th of July, 1860, at Dhurmsalla, in the Punjab. The cold of the fragments that fell was so intense as to benumb the hands of the coolies who picked them up, and who were obliged, in consequence of their coldness, instantly to drop them. With respect to the acceleration of the moon's mean motion, I would observe that it may perhaps be regarded as demonstrated by MM. Delaunay, Airy and Adams that the action of the sun and moon on the tidal protuberance generates such an amount of friction as slightly to retard the earth's diurnal rotation on its axis. The whole augmentation in the length of the day required is at the continuous rate of only one second of time in two hundred thousand years. Inconceivably small as is this amount of alteration in the length of the day, its effect on the moon's place could not be overlooked by a skilful observer of the present day. Perhaps, as has been justly said, herein we may recognise the highest and most successful effort of the human mind, or rather (as in truth it is) the combined efforts of a succession of minds. The final consequence of this diminution of the length of the day would be, says Helmholtz, but after millions of years—if, in the meantime, the ocean did not become frozen—that one side of the earth would be constantly turned towards the sun, and enjoy a perpetual day, whereas the opposite side would be involved in eternal night. Such a position we observe in our moon with regard to the earth, and also in the case of satellites as regards their planets. It is, perhaps, due to the action of the mighty ebb and flow to which these bodies, in the time of their fiery fluid condition, were subjected. From a contemplation of the planetary bodies we may arrive at fresh illustrations of continuity, and at conclusions with reference to the past as well as the probable future of our own earth. A number of singular peculiarities in the structure of our planetary system indicate that it was once a connected mass with a uniform motion of rotation. Without such an assumption it is impossible to explain why all the planets move in the same direction round the sun, why they all rotate in the same direction round their axes, why the planes of their orbits, and those of their satellites and rings, all nearly coincide, why all their orbits differ but little from circles, and much besides. From these remaining indications of a former state astronomers have shaped an hypothesis regarding the formation of our planetary system, which, although from the nature of the case it must ever remain an hypothesis, still in its special traits is so well supported by analogy that it certainly deserves attention. It was Kant who, feeling great interest in the physical description of the earth and the planetary system, undertook the labour of studying the works of Newton, and, as an evidence of the depth to which he had penetrated into the fundamental ideas of Newton, seized the notion that the same attractive force of all ponderable matter which now supports the motion of the planets must also, aforetime, have been able to form, from matter loosely scattered in space, the planetary system. Afterwards, and independently of Kant, Laplace, the great author of the *Mécanique Céleste* laid hold of the same thought, and introduced it among astronomers. The commencement of our planetary system, including the sun, must, according to this, be regarded as an immense nebulous mass that filled the portion of space which is now occupied by our system, far beyond the limits of Neptune, our most distant planet. Even now, perhaps, we see similar masses in the distant regions of the firmament, as patches of unresolved nebulæ, or unresolved nebulous stars; within our system, also, comets, the zodiacal light, the corona of the sun during a total eclipse, exhibit remnants of a nebulous substance, which is so thin that the light of the planets passes through it unenfeebled and unrefracted. If we calculate the density of the mass of our planetary system, according to the above assumption, for the time when it was a nebulous sphere, which reached to the path of the outermost planet, we should find that it would require several cubic miles of such matter to weigh a single grain. The general attractive force of all matter must, however, have impelled these masses to approach each other, and to condense, so that the nebulous sphere became incessantly smaller, by which, according to mechanical laws, a motion of rotation originally slow, and the existence of which must be assumed, would gradually become quicker and quicker. By the centrifugal force, which must act most energetically at the equator of the nebulous sphere, masses could from time to time be torn away, which afterwards would continue their courses separate from the main mass, forming themselves into single planets, or, similar to the great original sphere, into planets with satellites and rings, until finally the principal mass condensed itself into the sun. In this theory all that is hypothetical is the assumption of Kant and Laplace, that the masses of our system were once distributed as nebulæ in space. I have, in the above brief explanation of it, followed almost exactly the translated words of Helmholtz. His account is much more summary than that of Laplace, and perhaps requires expansion. In some future communication to this Society I hope to give a fuller account of the theory, and, in connection with it, to notice certain researches of Mr. Haughton and M. Babinet. At present I conclude with stating that Helmholtz, speaking of this theory of the origin of the solar system, remarks in what close coincidence the results of science here stand with the earlier legends of the

human family, and the forebodings of poetic fancy. The cosmogony of ancient nations generally commences with clouds and darkness. "Neither," adds the same great physicist, "is the Mosaic tradition very divergent, particularly when we remember that that which Moses names 'heaven' is different from the blue dome above us, and is synonymous with space, and that the unformed earth, and the waters of the great deep, which were afterwards divided into waters above the firmament and waters below the firmament, resembled the chaotic components of the world."

The PRESIDENT then informed the meeting that they had next to proceed to the election of officers for the ensuing year.

It was proposed, and carried by acclamation —"That Chief Justice Cockle be re-elected President."

The following elections were then proceeded with :—Mr. C. Coxen, Vice-President; Mr. Alexander Raff, Treasurer; Rev. J. Bliss, Secretary; Messrs. Jennings and Townson, Auditors.

The result of the ballot showed that the following gentlemen were elected to serve on the Council—namely, Dr. O'Doherty, Mr. W. Pettigrew, Mr. Wight, Dr. Waugh, and the Rev. J. Matthews.

The PRESIDENT having announced the result of the elections, the meeting terminated.

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PHILOSOPHICAL SOCIETY.

A meeting of the Queensland Philosophical Society was held on Monday, 28th inst. Chief Justice Cockle, F.R.S., in the chair.

After some routine business, Mr. TOWNSON proposed, and Mr. COXEN seconded, the election of Mr. Henry Scott, at the next meeting.

The SECRETARY laid on the table a Summary of the Meteorological Observations taken at Brisbane during the month of December.

Dr. O'Doherty not being present, no paper was read.

It was decided that the usual monthly meeting should, for the future, be held on the Friday nearest the new moon.

The PRESIDENT said that there was a circumstance, connected with recent historical or theological discussions, to which, as a literary curiosity, he might perhaps call the attention of the Society. The authenticity of the forty-sixth chapter of Genesis had been questioned on the ground that Hezron and Hamul were represented (verse 12) as accompanying Jacob into Egypt, and that without them there would not be threescore and six souls (verse 26). On examining the chapter he (the President) found that, excluding Hezron and Hamul and (of course) Er and Onan, sixty-six persons were enumerated by name. If to these we add Joseph and his two sons (verse 27) there will be a total of sixty-nine exclusive of Jacob's daughter Dinah (verse 15) there will be a total of seventy-one persons, Jacob being included. Substantially the whole discussion has turned on a supposed fact, taken for granted on either side, which, on investigation, appears to have no existence.

QUEENSLAND

PHILOSOPHICAL SOCIETY.

(From the *Queensland Daily Guardian*, March 30, 1867.)

SUGAR CULTIVATION IN QUEENSLAND.

PAPER READ BEFORE THE "QUEENSLAND PHILOSOPHICAL SOCIETY" BY MR. STRACHAN.

For many years it has been known that the sugar cane would grow and come to perfection in Queensland. But until lately there has been no means of knowing whether white labour could produce sugar in Queensland at such a cost as would enable it to compete with sugar produced by black labour in other countries. The object of the present paper is to lay before this society a statement of what has been done towards solving that question. In Jamaica, the sugar estates are paying their expenses, and enabling the proprietors to live well and save money; therefore, if I can show that the details of a sugar estate in Queensland can compare favourably with the details of one in Jamaica, it will be as satisfactory and more interesting than if I made this paper like the Dr. and Cr. sides of a merchant's cash-book.

Concerning the clearing of the land no comparison ought to be made, since fine rich land, without a tree upon it, can be got in Queensland for £1 per acre, which would be much cheaper than any land in Jamaica; or it might be land so thickly-timbered that it would cost £20 per acre before it was ready for the plough, in which case it would be more expensive. But it might so happen that the thickly-timbered land, being on a navigable creek and having other conveniences, might be the cheaper land in the end; therefore, clearing ought to be considered a part of the original cost of the land, which would be found to vary as much in Jamaica as in Queensland. In either country, let there be given a piece of land free from timber or other obstructions.

In Jamaica, the field-overseer (or bookkeeper as he is called, although he may never see the books) proceeds, with the assistance of two or three negroes, to mark off, on the ground, lines, four feet and a half apart; he then marks other lines at right angles to the first, four feet apart; at each place where these lines cross, a small stick is driven into the ground. The negro workmen then proceed with their hoes to make a hole, called the cane-hole, where each stick is placed, about 18 inches square and 9 inches deep, which is paid for at the rate of 3s. per 100 holes. Sometimes the land is ploughed previous to the cane-holing; in which case the cost may be a little less than I have mentioned, but then the extra cost of ploughing has to be added. Grass seldom gives any trouble in cane-holing, because the land has generally been fly-penned previously. That fly-penning is the common method of manuring, and may be thus described: A temporary stockyard or pen, made of bamboos, or sometimes of iron hurdles, is erected in one corner of the field, into which all the cattle on the estate—often three or four hundred—are driven in the afternoon, there to remain untill the next morning, during which time they have a plentiful supply of fresh cane tops as food. When the cattle have been four or five nights on that spot, three sides of the pen are taken down and re-erected, so as to enclose a fresh piece of ground, and so on until the whole of the ground has been covered by the moving or flying pen. The area of these pens seldom exceeds half an acre, so that the tramping of so many cattle on a confined spot puts a stop to the growth of grass for a time. The cane-holing being finished, the picaninny gang takes the matter up by the children lifting as many cane plants as they can carry in their

arms, and walking along the rows, dropping one or two plants in each hole, others following to cover them with a little earth. In that manner about 20 children will plant an acre at a cost of 10s.

In Queensland, at first, I used bullocks for ploughing, but found it far from satisfactory. The bullocks certainly did work that horses could not do, but it was very slow and very bad, the tramping of the bullocks doing almost as much harm as the ploughing did good. But when I got the steam-plough at work, I found that five men and two boys, viz., one engine-driver, one windlass-man to coil the wire rope, two anchor-men, one ploughman and two boys to shift the rope porters, could plough four acres, 14 inches deep, per day of ten hours. The same men could harrow to a fine tilth 10 acres a day; the harrows often running 7 or 8 miles an hour. In that well tilled soil, on which not even a man's foot had necessarily pressed, a ploughman with a pair of horses drew parallel furrows five feet apart, nine inches deep, of which work he could do five acres a day. As soon as possible after the plough, came three men who planted the canes; two of them carried a hand-barrow, on which was piled as many cane plants as were required for one row from top to bottom of the field. The third man walked a little in front and took a supply of cane plants from the hand-barrow as he required them and laid them carefully in the furrow, four feet apart. The men who carried the hand-barrow pushed a little earth on the top of each cane plant with their feet. In this manner three men could plant, well and carefully, two acres a day.

In Jamaica, when the young canes were about a foot high, they received the first weeding and moulding, costing about 10s. per acre; in four or five months afterwards a thorough weeding was required, as by that time the grass had recovered from the tramping it had received during fly-penning, and was growing luxuriantly; that weeding cost £1 per acre, often more. A third weeding was sometimes necessary. When the canes were about 10 months old, the dead leaves were removed, which operation was called trashing; at the same time all climbing plants, which are numerous, are removed; that first trashing costs £1 per acre. The cane is generally trashed a second and a third time before it is fit to cut, costing 10s. per acre each time.

In the soil of Cleveland, maize would not grow; although I planted it frequently, I got little more than the seed back again; but in most soil in which the cane will be planted in Queensland, maize will do well.

When the canes in Queensland were a few inches high, so as to show distinctly where the cane plants were, maize was planted in the four-feet space, not in the five-feet space, as that would have interfered with the work of the horses. In about a month afterwards a light grubber or scarifier, three feet six inches wide, with teeth running three inches deep in the ground, was pulled by one horse along the five-feet space, thus killing all grass in that space, and in its passage pushing down a part of the crest of the furrow, which gave the canes and maize the moulding they required. Three acres a day was an easy task for that work.

When the maize was old enough to require hoeing up it was done. That operation cleaned the canes of any grass the grubber had missed; when there was much grass, that cost £1 per acre. The grubbing was generally done twice more before the canes had grown sufficiently to check the growth of grass by their shade.

I found it best not to trash the canes until the following spring, as the dead leaves being left on protected the canes from the Queensland winter. Owing to the absence of all climbing plants, the cost of trashing was £1 for Bourbon canes, and £1 10s. for ribbon canes, per acre. In this drier climate only one more trashing was required about a month before the canes were cut; the cost was the same as the first trashing.

The cutting of the canes in Jamaica was always done by contract, not at a certain fixed price per acre, but each man engaged received one penny for every dray load of canes removed from the field; the bullock-driver received four pence per load, and his assistant two pence. In the following details concerning the number of men employed, I will refer to a sugar estate in Jamaica doing the same amount of work as the estate to which I refer in Queensland is able to do. That I can do without difficulty, as I knew four estates in Jamaica with machinery which was cast from the same patterns as the machinery I erected at Cleveland was. It is necessary to be careful in this respect, since the larger the machinery, the fewer men does it require in proportion to the work done.

In Jamaica, four men cut the canes at the root; six men lifted the canes from the ground, cut off the tops, and cut the canes to a uniform length of three or four feet; four men gathered the canes together, tied them in bundles with cane leaves, and stacked them in heaps. So many canes formed a bundle, so many bundles a heap, and so many heaps a dray load. It was the book-keeper's duty to occasionally count the canes in the bundles, and the bundles in the heaps, as a check on the work. The bullock-drays went over the whole field for the canes—the wheels and the bullocks' feet doing much damage to the cane roots, from which the next year's crop sprung. About 30 loads to an acre was a fair average.

In Queensland, while the canes were standing, two men with knives, something like large carving knives, walked one on each side of the row of canes, and cut off the tops at the proper place, with a *slanting* cut, which enabled the

canes to be easily griped by the mill-rollers. Four men with tomahawks cut the canes close to the ground, and the cane was sent its full length to the mill.

In well tilled ground, it was out of the question to think of allowing bullock-drays or even horse-drays to go over the fields for the canes; but as the Traction engine with its trucks was waiting on the road, in no case more than 10 chains distant from any of the canes, bullock-drays or horse-drays were not required. I tried to take the canes to the road in bundles, by means of an endless rope driven by the traction engine, but found it far from satisfactory. Taking the canes from the field to the road cost not less than £1 10s. per acre; whereas a light tramway or some other plan might do it for 15s., per acre. When the canes were on the road, the Traction engine could for £1 per day take all the canes to the mill yard that the mill was able to grind in that time, and with a little extra expense could have doubled or trebled that work. It was partly to make use of that extra power that I tried to make the engine pull the canes off the field.

Steam can never be applied to cut the tops off the canes, as it would be impossible to make it discriminate between the ripe and the unripe part of the cane; but I see no difficulty in applying it to cutting the canes at the root, by which means a considerable saving might be effected.

The grinding of the canes, and the boiling of the juice, is paid for in Jamaica, not by the quantity of canes, but by the number of gallons of juice. The usual price that each man receives is 3d. per clarifier of 600 gallons, the engine-driver and head sugar-boiler 4d.

Five men lift the canes from the mill-yard, where they have been thrown by the drays, and place them on the feeding-board of the mill; two men stand one on each side of the mill, pull the canes from the feeding-board, and push them in between the mill-rollers; two men remove the crushed cane, or begasse, sometimes by means of a truck and tramway; but I have seen 12 women engaged in carrying it away in baskets on their heads. A boy attends to the juice-strainers; one engine-driver, one fireman for the engine boiler; one man at the clarifiers; one head boiler and four men at the battery; two firemen at the battery; as they fire with dry megasse, it is almost constant work, so the one relieves the other now and then. The negro's idea of perfection in a fireman is described in a fable they have of a man made of iron, who, at some imaginary estate, was in the habit of getting inside of the furnace and shaking the fire up when it burnt badly. Two men are also employed in removing the sugar from the coolers to the hogsheads, which are placed in the curing house, where the molasses drains from the sugar, and runs at once to the distillery, no attempt being made to reboil the molasses. Six women carry the dry begasse from the sheds in which it had been stored from the previous crop, to the battery furnace. These women are paid 2d. per clarifier. In Queensland I used a cane-carrier, driven by the engine, to feed the mill; it consisted of an endless chain of boards, moving towards the mill at the same speed as the surface of the sugar mill rollers; on it the canes were laid, and I found that that moving table had a great effect in keeping the men up to their work, since, if at any time it was seen advancing uncovered with canes, it at once showed a neglect of duty. The canes being thrown from the trucks of the Traction engine, lay in large heaps and close to the cane carrier, very little work was required to put them on the cane carrier; two men attended to that, and one man directed the canes in their passage through the mill. The begasse fell from the mill into a truck on a tramway, which one man managed; a boy kept the strainers clean; one engine-driver; no fireman was required for the engine boiler, because I used a multitubular boiler, which enabled the waste heat from the battery to supply the engine with steam; one man at the clarifiers. At the battery, force pumps, driven by steam, were used, instead of the old fashioned ladles, which enabled two men to do all the work required. One fireman at the battery furnace, also two men at the centrifugal machines, who also put the sugar in bags for the market. The molasses was reboiled twice, and the remainder could have been sent to the distillery. A comparison of the distilleries is not interesting, since a well arranged distillery could be managed by two men, either in Jamaica or Queensland.

SUMMARY OF THE PROCEEDING.

Cost of One Acre of Plant Canes in Jamaica.

Bookkeeper lining cane-holes ...	£0 5 0
* Digging cane-holes	3 10 0
Planting canes	0 10 0
First weeding and moulding ...	0 10 0
Second weeding	1 0 0
First trashing	1 0 0
Second ditto	0 10 0
Third ditto	0 10 0
Cutting and carting canes to the mill yard	2 10 0
	£10 5 0

Cost of an Acre of Plant Canes in Queensland.

Steam ploughing and harrowing, including wood and water and oil for engine	£0 18 0
Ploughing furrows	0 2 0
Planting canes and maize ...	0 10 0
Carried forward ...	1 10 0

* In a book called the "Practical Sugar Planter," published in the year 1848, by Leonard Wray, Esq., the cost of digging cane-holes and planting canes in Jamaica is set down at £5 per acre, which is £1 more than I have stated.

Brought forward ...	£1	10	0
Grubbing three times	0	10	0
Weeding canes and hoeing maize	1	0	0
Trashing twice	3	0	0
Cutting canes	1	10	0
Conveying canes to the road ...	1	10	0
Cartage to the mill yard	1	0	0
	£10	0	0
From that deduct 10 bushels of maize at 3s.	1	10	0
	£8	10	0

(Three.)

Manufacture of Three Tons of Sugar in Jamaica.

17 Men at 3d. per clarifier ...	£1	17	6
2 Men at 4d. ditto ...	0	6	8
6 Women at 2d. ditto ...	0	10	0
	£2	14	2

(Three.)

Manufacture of Three Tons of Sugar in Queensland.

11 Men at 5s. per day	£2	15	0
Firewood	0	10	0
	£3	5	0

The value of the sugar in Jamaica is about £18 per ton; in Queensland, £35.

The following year, when the canes were rattoons, the cost per acre would be—in Jamaica £2, in Queensland £3, trashing alone being required. The cutting and manufacture would be the same as before stated.

It may seem strange to those who have been constantly in the habit of seeing horses used in keeping the ground clean among maize, cotton, &c., when I state that, although in attending to my duty as an engineer I have been on most of the sugar estates in Jamaica, I never saw a grubber or cultivator of any description, neither did I ever see a plough used to clean the canes: the hoe is the universal implement. In all books on sugar cultivation the use of the plough is so strongly urged that one would think that ploughs were quite common; but such is not the case in the present Jamaica practice.

Some account of the experimental manufacture of sugar at Cleveland may be interesting:—

In April, 1864, I ground 5,000 gallons of cane-juice from Bourbon canes—density, 7 degrees by Beaume's saccharometer; from that I got little or no sugar—it would not crystallise. The result of that boiling did not lead me to suspect anything wrong with the canes, since it was evidently not the proper time to cut the canes; the juice was very weak, and it was the first trial of the works. I did not again start the mill until September following, when I ground 5,000 gallons of ribbon cane-juice, density 10½ degrees Beaume. From that I obtained three tons of dry sugar. As those canes were grown on rather less than one acre of land, the result was as satisfactory as anyone could wish. None of that sugar was sent to market; as I had not then got the centrifugal machines, I had not the means of making it look as well as the ordinary sugars in the market, and if I had sold it, it would only have been necessary to have bought more for my workmen.

In September, 1865, I ground 2,800 gallons of Bourbon cane-juice, density 10 degrees, which gave no sugar; but as these canes had had three days of very heavy rain on them after they were cut, I thought the rain might have spoiled them, but still I thought that the canes were not what they ought to be.

I next ground 1,000 gallons of ribbon cane-juice, from which I got 1,000 lbs. of very good sugar. There seemed to be room for improvement in the colour of the sugar, therefore in boiling 2,000 gallons of ribbon cane-juice in October, I made an alteration in the process; the result was that the colour was improved but the proportion of sugar to juice was not quite so good.

I next ground 3,000 gallons of Bourbon cane-juice, under very favourable circumstances, but still the proportion of sugar to juice was so very small, that I felt quite convinced that there was some foreign matter in the juice, which prevented the sugar from crystallising. I, therefore, before grinding any more, tried a great many experiments on a small scale, which although they did not enable me to find out exactly what the foreign matter was, these experiments enabled me to see how I could do so on a larger scale.

In November I ground 10,000 gallons from the Bourbon cane. Then by removing the juice from the open boilers, at a density of 25 degress instead of at 30 as is usual, and by keeping the temperature of the Bour pan below 160 degrees, instead of 185 degrees as is usual, I succeeded in depositing in the Bour pan large quantities of the substance I will now show. The sugar now crystallised a great deal better, but still not so well as to make me wish to have anything more to do with Bourbon canes, grown in Queensland red soil. Some of this substance was sent to Sydney, and the chemist who analysed it reported that it was pure sulphate of lime with a trace of vegetable matter.

In December I ground 1,200 gallons of juice from Bourbon rattoon canes; and, strange to say, there was no sign of the troublesome sulphate of lime; it gave 1,000 lbs. of the best looking sugar I had then made. The plant seemed to have exhausted the soil of the sulphate of lime in its first growth. But I fear that if the land were ploughed and replanted, the canes, would find sulphate of lime for many years to come. When the Hon. F. E. Bigge sent his canes to be ground, he engaged a man to boil the sugar who had had

thirty years' experience of that work; the result was the same, he did not make a grain of sugar from the Bourbon canes, but the ribbon canes did very well. Mr. Raff sent some Bourbon plant canes from the Cabulture for me to test; they made very good sugar without any sign of sulphate of lime. I do not think there will be any difficulty in making sugar at the Cabulture from the Bourbon cane; perhaps some other variety may do badly there. This experience shows how necessary it is to plant a variety of canes, at first so as to discover as soon as possible which is the best suited to any particular soil.

In Jamaica, in the low-lying parish of Westmoreland, where the estates are situated on the alluvial flats, along the banks of the Cabberetta River, the Bourbon cane is the favourite, but in the higher parishes of Hanover and Trelawney the ribbon and violet canes are preferred, so much so that on many of the estates a Bourbon cane is not to be seen.

There will not be the slightest difficulty in making sugar at Cleveland in future, as there are no bad canes left. There were no Bourbon canes planted there after after May, 1864, and most of the Bourbon rattoons were ploughed up and ribbon canes planted instead. Out of the 80 acres of canes now growing at Cleveland, there are only 10 acres of Bourbon canes, and those are rattoons, which will give no trouble.

In January, 1866, Mr. Martin sold at his auction rooms, in Brisbane, one ton of sugar, being samples of sugar made at Cleveland.

The following are the prices at which they were sold:—

	per cwt.
Sugar made from ribbon plant canes	44s.
2nd sugar from ditto	37s.
Sugar made from Bourbon rattoons	47s.
2nd sugar from ditto	37s.
Sugar made from Bourbon plant canes after the sulphate of lime was separated	35s.

A few days after that sale, I ground half an acre of ribbon canes, consisting of 1,000 stoles, which gave 3,080 gallons of juice, density 11 degrees, and the result was 1 ton 13 cwt. 3 qrs. and 20 lbs. of dry sugar. Of that quantity, 2,380 lbs. was of a better quality than that which was sold for 47s. per cwt. I left 20 tons of molasses at Cleveland. If the canes had been good, that might have been 20 tons of sugar, or, with a still, that molasses would have made 3,000 gallons of rum. I may also mention that a traction engine and steam-plough, like the one I referred to, can be delivered here for £1,000; the engine is warranted to pull 50 tons along a level road. In addition to carting canes and ploughing, I found the engine very useful in clearing land, as it was able to pull all oak and small gum trees right out of the ground without any stumping.

In these remarks that I have made this evening, I have very far from exhausted the subject, there being many points to which I have not even referred. But if I have succeeded in throwing any satisfactory light on a subject that is of so much importance to Queensland at the present time, I shall feel satisfied.

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THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

(From the *Queensland Daily Guardian*, May 18, 1867.)

A MEETING of the Members of the PHILOSOPHICAL SOCIETY was held on Saturday, the 18th of May, at which Mr. GEORGE WIGHT read the following Paper

ON THE APPOINTMENT OF A GOVERNMENT GEOLOGIST FOR QUEENSLAND.

Three months ago, when I engaged to prepare a paper "On the appointment of a Government Geologist for Queensland," to be read before the Philosophical Society, and to form the basis of some practical action in the matter, I had a strong conviction that were such an officer appointed the results would be very beneficial; and now since I have devoted some considerable attention to the subject, in all its bearings, that conviction grows in strength.

The members of the society will understand that this paper is not intended to be a disquisition on the science of geology. We must, indeed, make free and frequent reference to the science, and may sometimes venture to advance an opinion on controverted points; but this shall be done only so far as it may appear necessary to gain the end contemplated. The appointment of a thoroughly practical geologist by the Government is, in our judgment, the best, cheapest, and speediest means of guiding and aiding the development of the vast natural resources of Queensland. This is the ground that we take in this paper, and we shall now do our endeavour to make good the position.

It is not very many years since geology was considered by many as both a dangerous and a useless science. We can remember the time when Christian men had a fear lest it should undermine the Book of their faith, and when even practical men were wont to say—"It is all very well for those who have leisure, and whose tastes lead that way, to investigate the so-called facts of geology, and follow its wild deductions; but, when all is done, what is the use?—what results, of a practical nature, are likely to follow?"

Strong as the prejudices have been against geology, perhaps no science has more speedily and satisfactorily relieved, if it has not removed, the groundless apprehensions of some good men relative to its legitimate results; and certainly it would be difficult to name a science that has so quickly and so universally risen into favour on the acknowledged ground of its high economic value.

The modern estimate of this science is just: In the rocky crust of the earth there are many proofs, legible enough to those who have eyes and courage to read them, of the Divine Attributes; and the vast accumulations of rocky materials, with which the geologist has made us familiar, furnish, perhaps, the grandest commentary on the Bible designation of the Great Creator,—"The ANCIENT OF DAYS." It is now generally acknowledged that, while geology derives aid from other sciences—such as chemistry, mineralogy, Ichthyology, conchology—the obligation is mutual; and, besides, it is freely conceded by all persons of intelligence that it affords, in a variety of ways, liberal assistance to the most practical of all the sciences, and contributes largely to the success of the most useful of our great industries. Modern agriculture is immensely its debtor; civil engineering is much beholden to it; and it is the basis of all thorough and trustworthy mining operations. Hence, the Governments of the European nations have found it incumbent upon them to establish and maintain, in some instances at a large annual expenditure, a Geological Department for the scientific and economical development of the natural resources of their respective countries. Establishments of this kind exist in countries whose mineral treasures do not include the precious metals; and even in these circumstances, when efficiently worked, they amply repay the money expended. The Geological Department of England, for example, where the precious metals are so sparsely deposited that they may be considered as not existing, is doing an amount of good in which, one way or other, every subject of the Crown may have an appreciable share. By the elaborate system of geological surveys whereby the country is being accurately mapped; by the establishment of an extensive and well-ordered museum for geological specimens, open to the public; by reports of field operations, and memoirs on important discoveries; by periodical series of popular lectures, with illustrations, by the ablest men on the staff; by printed journals and books;—the physical features of the country; the character of the soils; the nature of the rocks; the value of the hidden deposits in any part of the British

Isles may be ascertained by any man of ordinary capacity and observation. It is impossible to over estimate the importance of this varied information to the landed proprietor, to the would-be purchaser of land ; to the farmer, to the miner, and to the man whose fortunes may be low, and whose health may require resuscitation. Before we possessed the knowledge which geology alone can impart, or before men's prejudices permitted them to use it, many fortunes were lost in the haphazard search for minerals in the British Isles ; and it is equally true that, guided by the light which this science so liberally diffuses, many fortunes have been, and are being made, from lands whose grazing and productive powers yielded but a poor return for the capital invested. The iron master, the potter, the coal proprietor, the lime merchant, the copper miner, as well as the land proprietor and farmer, are laid under heavy obligations to the geologist, and also to the paternal government of Britain by enabling them through the establishment of an efficient Geological Department to make the researches of science available for these purposes of national utility.

The institutions of the mother country gradually, but surely, spring up in colonies of British origin, characterised by British spirit and energy. Thus we find New South Wales, New Zealand, Tasmania, and Victoria following in the steps of the parent country ; and glad should we be were the discussion of this question at the present suitable time, to help to induce this colony to initate such worthy examples. In the first-mentioned colonies the geological departments, if they can properly be so designated, are limited in their operations, and inexpensive in their management. So far as can be learned from the New South Wales "Blue Book" for 1865, there are only two gentlemen, besides the gold commissioners, who can be said to be engaged geologically in that colony, and that at the rate of about £1,000 a year. In Victoria the English geological department has been taken as a pattern, and, consequently, the establishment is organised on a broad basis. There is a well-selected staff of practical men, under the efficient directorship of Mr. Selwyn, a distinguished pupil of Sir Roderick Murchison, and the sections and geological maps produced by them are engraved by first-class artists, printed from the stone in great numbers, and sold at a cheap rate to the people.

I have been favoured, by the courtesy of Mr. T. Ham, Chief Engraver to our Government, and formerly Chief Engraver to the Geological Department, Victoria, with some specimens of the sections and maps referred to, and which I now beg to place on the table for the inspection of the members.

The geological department in Victoria has done much to guide and assist the development of the mineral treasures of that colony.

It would be superfluous to dwell on the fact, attested by men of science, partially demonstrated by private enterprise, and believed in by everybody, that Queensland, one of the healthiest of the Australian group of colonies, is also one of the richest endowed by a beneficent Providence.

In many districts coal of good quality, and some of it really excellent, abounds ; and though it is not much sought after at the present time, yet it will, we are confident, before long be extensively worked for the supply of coasting steamers, and the steam fleet that is destined to make Torres' Straits the commercial highway between Australasia, the Dutch Settlements, and the Eastern Dominions of her Britannic Majesty. At a time when England is expressing great concern regarding her coal supply, we may congratulate ourselves on the fact that when our vast primeval forests have yielded to the axe, and given place to cotton plantations and sugar estates, our coal fields will furnish fuel for the consumption of millions of people, for countless generations. Here is a mine of wealth of untold value, and not the less real because it is at present an unimportant interest, and amidst the numerous claims on the men of enterprise and capital, all but overlooked.

In the northern parts of the colony copper ores are believed to exist in great abundance : and in more than one locality the lodes have yielded a high per centage of the pure metal. There is no doubt that copper mining will, in time, occupy a portion of our energy and capital, but for the present the want of independent investigation, and of authoritative reports such as would emanate from a Government official, impedes the employment of both.

As regards gold—that most potent of motives to stir up human energy—scientific men, who have only partially examined and studied our mountain systems, and old miners from the South, who look upon matters with a practical eye, agree in declaring that, unless nature belies herself, the auriferous deposits in this country are both extensive and rich. No systematic effort has been put forth to test these opinions and appearances, and yet the results of limited, isolated, and too often fitful attempts have gone to prove the opinions of the geologist and miner to be correct. There is a glorious future to Queensland in the extension and improvement of her pastoral interests ; in the growth and establishment of her semi-tropical agriculture ; and in the development of her mineral treasures.

At the present time attention is very generally directed to the mineral resources and auriferous deposits of this colony. His Excellency Sir G. F. Bowen, in the vice-regal speech, makes the following hopeful and encouraging

remarks : "The export of gold during the past year amounted to £85,561. As compared with the neighbouring colonies, we do not at present rank high as a gold producing country; but when it is remembered that but little capital has been hitherto invested in machinery, the amount just quoted tends to show that the employment of the methods adopted elsewhere would in all probability confirm the opinion entertained by scientific observers, that our auriferous deposits are both extensive and abundant." We quite agree with His Excellency that "the methods adopted elsewhere," judiciously employed here, would speedily result in the increase of our gold fields, the extension of our machinery, and consequently in the general prosperity of the people. We have briefly referred to the methods adopted in the Southern colonies, and we trust that our authorities may see their way to adopt them here. It is well known that the Government have already offered a handsome reward (£5,000) for the discovery of a paying gold field, and they have also announced that £1,000 will be paid, on certain reasonable conditions, to the person who discovers the existence of oil bearing shales. This is so far good; and it shows at once the interest taken in these matters by our rulers, and indicates the prevailing feeling among the people. But this is not enough; nor, in truth, is it the most likely "method" by which the end contemplated will be speedily gained. The other colonies have, indeed, voted money and offered rewards; but they have done more. They have engaged competent men of science to survey, geologically, the most likely places where the precious metals were to be found; and these men have reported to their respective governments, and thus provided, in many instances, a sure guide both to the Government and the public.

Believing that this is the true method by which our auriferous deposits are to be discovered, and the people guided in the working of them, we venture to suggest that the rewards now generously offered by the Government should stand good for other twelve months from this date; and that a competent person—an experienced field geologist—should be at once appointed, with the title of Government Geologist, and having at least one scientific assistant. This officer should take the field without delay, that both the Government and the public may have reliable information relative to any given locality. His special duties would be to carefully examine the local strata, ascertain their relation to the general geological system, learn the character of the quartz reefs, and the alluvial deposits, and trace the general geologic features of the country. A brief report should accompany each feature-map, and both should be issued to the public with the least possible delay. The sale of the maps would pay for their production; and the reports could be placed before the public through channels that would incur no expense. The people wish to know where gold may be found in paying quantities, that they may go and work for the support of their families and themselves; and, therefore, it is advisable that all official information should be promptly and widely published. A vote of about £1,500 a year would suffice for the efficient working of such a staff as is here suggested.

The following reasons may be given for the appointment of a thoroughly competent geologist by the Government :—

1. It is the duty of the Government to adopt the most approved methods for the developing of the natural resources of the country, over which they have been appointed to rule. This is, indeed, a truism; but it is, perhaps, on that ground apt to be neglected. The rulers of a people can be justified in disregarding this plain and primary duty, only on two grounds, neither of which exists in our case,—the inability to procure, and the inability to employ the requisite instrumentality. The instrumentality is within reach—competent men are to be found,—if not in these colonies, at all events, among the ranks of the English geologists. And the expenditure which a suitable staff would incur, is neither beyond our ability nor contrary to our will, as witness the rewards at this time offered by the Government.

The question may be raised,—"Which is the best method—is it the offering handsome rewards, and waiting, as it were, for chance to discover the auriferous deposits; or is it by bringing science to our aid, and thus compelling Old Nature to unlock her treasures?"

Reasoning from analogy, and walking by the experiences of other countries, both in the old and new world, we should decide in favour of science. It is the more certain process, and it is probable that it will be more speedy in securing satisfactory results. What science has done for Britain, what science has done for Victoria, science will do for Queensland. The Government must be sure, however, that they obtain true and clear-eyed science, not the old fogyism of departed theories.

In this case much of the success depends on the type of man, and the school in which he has been bred. Every man who may claim some acquaintance with the science, is not fit to perform with success the functions of this important office. We have been led to speak of these two methods, but we do not place the one as antagonistic to the other. Both might be employed with advantage, for while science went coolly and philosphically to work; prompted by the reward, many hands and eyes would be scanning the likely localities for the precious treasures. But if a choice is to be made—if we can properly afford to employ

only one of these methods—then, by all means, let Chance give place to Science. The wisest thing that our rulers could do in this department, is to appoint a competent man and set him to work.

2. There is depression and distress in the community, and it is the duty of a paternal Government to open every channel through which relief may flow. The present condition of this colony is exceptional—the depression and distress are temporary. If, however, these could be relieved promptly it would be well; and only to prevent their recurrence in the future would be a great thing gained. The employment of a Government geologist would not do all that the people want, but it would inspire them with hope, and as hope prevails depression is relieved. And this appointment would soon be followed by some tangible results. Men cannot live on hope, and expectation will not satisfy hungry mouths.

The geologist would visit those localities most likely to contain the precious treasure in paying quantities. He would examine them and report to the Government. He would describe the character of the reefs and the alluvial deposits as the case might be. He would suggest where gold is most likely to be found, and the most probable method of working it. On the map which he constructs, the relative position of the rocks is indicated, and the gold-bearing veins are traced. With this official map and report in their hands, men see what they are about—they know what to do. If they resolve to try their luck at gold-digging, they go at it with a will, and in all probability, with success; because they have received the necessary information, and they bring to the undertaking the necessary determination and perseverance. Necessity is said to be the mother of invention. Necessity has originated many useful and permanent works; and we shall hope that in the present case, the necessities of the people will prompt our rulers to employ the most likely methods to provide for them full, permanent, and remunerative occupation.

3. This appointment would bring the right men and the requisite capital, to work our mines of iron, coal, copper, and gold. Those who have been resident in Queensland for a few years must have observed with regret that the news regarding gold discoveries, coal seams, and copper mines, has generally been partial, exaggerated, or in some respects unsatisfactory. Perhaps this was incidental to the circumstances of a young colony; perhaps it is a colonial characteristic, with which we can very well dispense. Be this as it may, we have suffered by it. It is easy to see how the evil may have originated and how it may have been perpetuated, to some extent, to the present hour. In the past, something like the following has happened:—A storekeeper, or wayside publican, finds a sample of gold, or meets with some one who has, and forthwith he writes to the newspapers, giving a glowing description of the locality, and a sanguine estimate of the gold to be found there. The main object has sometimes been to bring population; and as they must have both food and drink, the storekeeper disposes of his goods, and the publican deals out his drinks at excellent profits, while the dupes of this "dodge" spend more gold than they extract from mother earth. The result is disappointment and disgust. The case, however, may have been reversed. Gold may really be known to exist in paying quantities, but the working of it would encroach on some one's supposed rights. It is not considered desirable that a digging population should congregate there, so a communication is forwarded to the press, asserting that the whole affair is the nearest thing to a hoax, and hinting that none but fools would be influenced by the vague rumours that are flying about. Under one set of motives the floating population of a district may be drawn to a point where there may be little more than the "colour" of gold; and under another set—both, however, having their origin and end in selfishness—the portion of the public, more especially devoted to this occupation, are prevented from visiting that part of the country where the gold is both good and plentiful. Since the proclamation of the few gold fields which are now being worked matters have assumed a more favourable aspect, the commissioners forming a medium of communication with the public by means of periodical reports to the Government. Still, the presence of a commissioner on every gold-field is no argument against the appointment of a Government geologist. Newspaper paragraphs, and letters from local correspondents, however truthful they may be, have little influence on the men that we should like to see engaged on our diggings, and they have still less influence with the capitalists who may be looking out for some good investment.

There are many men of skill and experience in gold-digging ready to come to Queensland; there are capitalists in the South and in England, who are prepared, we are informed, to invest in machinery for the working of our mineral treasures; but these men will not be led a wild goose chase, they will neither come themselves nor invest capital, except on the ground of official reports by a competent man of science. They are prepared to take the risk, but it will only be on the authority of the Government.

This, therefore, is the conclusion to which we come, namely—That the cheapest, speediest, and most certain method for the development of our abundant natural resources, is the immediate appointment of a competant Government Geologist. This course is commended alike by policy and by patriotism.

THE

QUEENSLAND PHILOSOPHICAL SOCIETY.

(From the *Queensland Daily Guardian*, June 29, 1867.)

At a meeting of the Philosophical Society, held on Friday, June 28th, the Rev. J. Bliss in the chair, the following paper was read by Dr. Bancroft :—

Everybody has heard of sheep scab, many think it is a disease, some are aware that a minute insect is the cause of the mischief, but very few who have the management of sheep are able to recognise the parasite, or to eradicate it. Hence the law of this country compels the squatter to destroy his scabby flocks.

To understand the nature of sheep-scab is very easy, and to remove it is by no means difficult.

It is my intention to describe the sheep-scab insect, to show you specimens, and to point out measures to ensure its destruction.

Scab, or hardened secretions that mat together the wool, may be the result of various diseased conditions, but the contagious scab here referred to, is that produced by the irritation of a minute insect which bites the skin, causing it to discharge fluids that dry in the wool, forming hard brown encrustations, so extensive that the greater part of the fleece is often matted together by them.

The sheep suffer much from itching of the skin, which causes them to pluck wool from the parts they can reach ; they also rub a great deal off other parts, so that they have no fleece of any value. Their health also suffers from the continuous irritation, which is most intense in warm weather. Purulent secretions, from ulcers and boils, are poured out, and fissures among the scabs bleed when the animal rubs itself. Emaciation commonly takes place.

The scabs can be softened by water, and with great pains removed from the wool.

They consist of hardened serum of the blood, pus, blood, epidemic—scales, and foreign matters mixed therewith. It is often thought advisable to remove these scabs in the treatment of the disorder, but there is no necessity to do so.

The scab described is simply the result of the irritation produced by a parasite of the arachnida or spider family.

It is a mite of about a thirtieth of an inch in diameter, and can be seen by the naked eye, as a minute white speck, firm and globular, not a mere scale, such as may anywhere be lifted from the skin.

When a person with good eyes has had the insect shown to him, he will be able to pick them from among the fibres of wool with great ease. By putting an insect between two pieces of window glass, and using slight pressure, its legs may be seen. A drop of oil will better enable one to see the parts of its body, and a weak lens will magnify it sufficiently for ordinary examination. An insect so imprisoned in a drop of oil and held up to the light of the sun or a candle, cannot be mistaken for anything else, and its movements, if not too tightly pressed, can be well observed.

Should it be difficult to find the insects on the living sheep, the skin of a newly-killed animal will be more convenient for examination.

The insects will be found at the bottom of the fibres of wool, not far from the scabs.

They do not live on the scabs, for having set up irritation, causing scabs to form in one part, they move to sounder skin.

They will often be found on the fibres of wool along which they have the power to climb —also adhering to the skin, though, unlike the itch insect, never burrow under it. With careful search, a family party of twenty or more may be found together, the individuals of which

are of various sizes and ages, together with eggs.

By examination with the microscope, this mite will be seen to have a globular body with eight legs, both body and legs being covered with scattered hairs. The legs, with the exception of two, have a hook and sucker attached to each, and those two have a long hair-like appendage.

Theinsect is called by Gerlach *Dermatodectes ovis*—literally, skin-biter of the sheep. He computes the rate of increase as follows :—

1st generation in fifteen days, 10 females and 5 males

6th generation in ninety days, one and a-half millions

The small amount of injury these minute creatures can produce by their bites will not account for the great torment the sheep endures, so that we must infer from the results that a poisonous fluid, secreted by the insect, is at the same time introduced into the wound, and that the poison is the chief cause of the irritation,

We see similar effects from the bites of mosquitoes, sand-flies, and ticks; the wounds made by these creatures being altogether insignificant.

Their powers of endurance after removal from the living sheep is believed to be great. On examining skins of sheep killed a fortnight, I have found all the insects dead. From what is known on this subject it is quite clear that the scab insect cannot be propagated except from eggs, and, if the creatures were once completely destroyed from Australia, they could not again come into existence without importation.

Many contagious diseases have a spontaneous origin, or what appears to be spontaneous to our present knowledge, but, in the case of scab, the fact holds good, *omne vivum ex ovo.*

Many applications have been used to destroy the scab insects, amongst which are various compounds of mercury and arsenic.

Mercurial ointment was much used in England, and frequently produced salivation and death of the animals.

Corrosive sublimate dissolved in water, to the extent of an ounce to the gallon, is not so liable to produce salivation, but is still a dangerous compound.

Such washes are liable to drip upon the grass, which thereby becomes poisonous to the sheep, great numbers having thereby perished. After using such solutions it is advisable to keep the sheep in a yard until the fleeces dry. Arsenic is the active ingredient in most of the washes sold, and is combined with various substances of a less noxious quality.

Six ounces of arsenic, with an equal weight of carbonate of potash, added to fourteen gallons of water, is highly recommended.

The caustic soda now imported in iron cases for the soap makers, would be cheaper and better than the potass.

Tobacco has properties which recommend it as the safest wash for general purposes, and, being free from the deleterious qualities of mercury and arsenic, should be used by all inexperienced men.

Half a pound of the coarse rank tobacco, which can be grown here so plentifully, is sufficient for a gallon. It should not be boiled in the water, but have boiling water poured on it. Boiling expells some of its active principles. Half-an ounce of caustic soda per gallon adds much to it efficacy. If more tobacco could be used it would be advisable. Sulphur is the great remedy for itch in the human subject, and is more potent if combined with potass or soda. By heating six pounds of caustic soda with one of sulphur for a short time over a fire, the sulphur amalgamates with the soda and becomes soluble in water. This article will be found very effective in eradicating scab, half-an-ounce of which to the gallon makes a wash that is not poisonous to the sheep. Tobacco mixed therewith forms the wash, in my opinion, the best that can be used.

In employing this wash, it will be most convenient, to construct a wooden tank four feet deep, into which the sheep can be driven a few at a time. An inclined plane, constructed on the side the sheep get out, allows the wash that drips from the wool to run again into the tank. If arsenic be used the efficacy of that mineral can be increased by the addition of the caustic soda.

It is important to bear in mind that the eggs of the scab insect are killed with greater difficulty than the insect itself. This is the cause of the continuance of the disorder. To eradicate the pest, the sheep should be dipped in an effective solution weekly, for the space of a month, and if there be any suspicion of the continuance of the affection, dipping ought to be used until all suspicion is removed. In using tanks of wash the labour of dipping is so much diminished that the prolonged attention necessary is not found very inconvenient.

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QUEENSLAND PHILOSOPHICAL SOCIETY.

COCCUS INSECTS.

The following paper was read by Dr. Bancroft, at the Monthly Meeting of the Society, August 1869 :—

"At one of the meetings of this society during last year, it will be remembered that the subject of Coccus wax was introduced by me, and that I burnt a small candle made of this substance.

"It is intended in this paper to give the results of further observations on the insects producing this wax, and to offer some remarks on another curious product of the same insects—viz., manna—a variety of sugar at present little understood.

"From the same family of insects (Hemiptera) other important commercial products are obtained, and which I here mention as it will be necessary to refer to the insects producing them. These are the Cochineal dye, and the material lac, commonly known as shell-lac.

"These insects thus produce wax, sugar, dye and lac.

"There are several insects living here that produce wax. The largest of which lives on various species of eucalyptus, and may be seen in great numbers occasionally.

"The females are wingless, though it may be that a second form of insect has wings. The wingless one is over half an inch long, and is covered by a large mass of white downy wax, that falls from her body in quantity sufficient to whiten the ground near. After the removal of the down, the body of the insect is found of the shape of a large wood louse, of a bright red color. There is much yellowish fat in her body. The male insect may occasionally be found—a winged hopper—rarely more than one on the bush, on which live a great many females.

"On account of the loose downy nature of this wax, it is not easy to collect it in any large quantity.

"The wax insect next in size to this is found on many species of trees in our dense scrubs. It is found adherent to the small twigs in great numbers. It is milky-white, half-an-inch long, convex, and irregular externally. When removed from the bark, the true body of the insect is seen as a small red centre. The wax, which coats the body to a considerable depth, is not solid, but contains a watery tasteless fluid in cellular meshes. A dried insect weighs about two grains, which is mostly wax.

"This is the one from which the candle is made.

"A wax insect is found on some of the acacias about one-eighth of an inch long, convex, smooth, and in large masses.

"One about the same size I have found on the tea-tree (*Melaleuca*). It lives on the leaves, many of which are covered with insects. These are very curious, and when young have ten arms like a miniature starfish. Under a low magnifying power they are beautiful objects. As the insect increases in size the arms coalesce.

"A wax insect, half an inch long, is found on oranges and other trees. The convex dorsal surface is reddish and powdery, but to its posterior margin grow waxy hairs to a considerable distance. The upper surface of the mass is furrowed as if marked by the teeth of a comb. Under the microscope the wax is seen to consist of spiral fibres, which, when broken, appear as rings.

"Wax is found on the bodies of most insects of this order, and becomes a protecting medium. It is frequently employed to make a nest for the eggs. The white patches on the gum trees consist of wax in which are found eggs of a species of hopper. The wax in this case grows on the abdominal scales of the mother. In the large galls found on various eucalypti a waxy powder enables the contained insect to move about inside its house with less friction than would otherwise occur. Lastly, the insect resolves herself into a myriad of minute insects, which creep out of the opening in the apex of the gall.

"A scale insect on the mistletoe is enclosed in a pearly shell of wax.

"The silvery substance that colors the cochineal insect consists of wax.

"The following description of the Chinese wax insect is from Pereira's 'Materia Medica':—

"'INSECT WAX OF CHINA, PE-LA.

"'Upon the authority of Sir G. Staunton, the insect from which Chinese wax was derived was considered to be a *cicada*, and described as *cicada* or *flata limbata*. Recent researches have, however, shown that the wax insect is a species of coccus, called *Coccus Sinensis*. This insect is reputed to feed on the *Ligustrum lucidum*, but this is doubted by Mr. Fortune. He assigns the place to some species of ash *(fraxinus)*. The wax insect is chiefly found in the province of Sze-tchuen. In form it is not unlike the oval wood-louse. The crude wax is deposited by the insects around the branches of the tree on which they feed, and a white soft fibrous velvety coating of from one to two-tenths of an inch in thickness. The deposit therefore takes place under circumstances very similar to those in which lac resin is met with. According to Dr. Macgowan, the annual product of this insect in wax is about 400,000 pounds. At Ningpo, the wax costs from 1s. to 1s. 6d. per pound.

"'Mr. Hanbury states that in 1846-7 three tons of this wax were imported into London. It fetched only 1s. 3d. per pound, a price too low to be remunerative. It is used by the Chinese as a medicine, &c., &c.'

"Japan wax, now an article of trade, is said to be produced from a plant, *Rhus succedanea*, which is cultivated by the Japanese in their gardens. I suspect that this wax is, however, the secretion of a coccus also. Many insects of this order excrete a fluid rich in sugar, which is mostly eaten by ants that attend upon the insects for that purpose. This may be seen on plants infested by aphis scale, coccus, and hoppers.

"In some cases the fluid is not saccharine, as the froth of hoppers. These insects in bright sunny weather cause a constant shower of drops to fall from the trees they inhabit.

"In some cases aphis and scale insects cause drops of honey to fall on the surface of leaves, forming what is called *honey dew*. It is on the surface of leaves thus coated that a black fungus grows which feeds on the sugar. When the sugar is exhausted the fungus dies, and is washed off by the rains, leaving the leaves uninjured. I have been able to grow this fungus on glass smeared with a solution of coccus sugar.

"It is interesting to watch the ants tending a species of hopper that lives on the tea tree. These hoppers excrete a large globule of honey, which is immediately seized by the jaws of an ant, and is carried off a short distance to be swallowed. This insect being large, it is easy to observe everything with the naked eye.

"In some honey-excreting insects the sugar crystalizes on the body of the insect, forming a grain of sugar of irregular shape. This keeps increasing until it falls off from its weight. From a large scale insect on one of the eucalypti, I have been able to collect a quantity of this crystallized sugar. The crystals are needle shaped. Fermentation takes place in a solution of it.

"This constitutes the manna found in many parts of Australia, which is said to be formed by a winged insect.

"I have evaporated the sweet excretion of a winged hopper, common here, and produced acicular crystals of sugar.

"For the following interesting account of this manna, I am indebted to Dr. Bennett's book:—

"'The Australian manna examined by Dr. T. Thompson and Professor Johnson, was found to differ in many of its properties from European mannas, and was ascertained to contain a species of sugar resembling, and yet different from, mannite; the latter gentleman removes it by his formula altogether from mannite, and brings it into the class of true sugars, containing hydrogen and oxygen in the proportion to form water, and further establishes its isomerism with grape sugar, from which, however, it manifestly differs in its properties. This is considered to be secreted from the tree, as I have stated in my 'Wanderings in New South Wales.' But there is another saccharine secretion observed in various parts of Australia, and also in Tasmania, resembling a fluid exudation upon the leaves, different from that before-mentioned, and possessing, when dried, a regular crystallised structure. It is the *Lerp* of the natives, and is found principally covering the leaves of the mallee tree (*Eucalyptus dumosa*) in the southern districts of Australia, forming small conical cups, covered externally with white hairs, curled in various directions. This substance has been ascertained to be secreted by an insect of the genus Psylla; and it has been mentioned as 'very nutritive, the natives subsisting upon it, and becoming fat during the season in which it is found; it adheres with very little tenacity to the leaves, and is immediately washed off by a shower of rain.'

"Although the taste of *Lerp* is saccharine, the sweetness appears to be confined to the hairs; the cup, separated, being only slightly mucilaginous.

"An excellent account and analysis of these substances were published by Dr. T. Anderson, in the 'Edinburgh New Philosophical Journal, for July, 1849.'

"'The beak of the Tettigonia is hard and horny, and constitutes an apparatus for perforating the bark and sucking the juices of trees. It has been asserted that it bores the manna-tree of Australia (*Eucalyptus viminalis*, Labill), causing the manna to exude, whilst

others consider that the manna is a saccharine secretion produced from an insect of another species.

"'The blacks of Goulburn Plains told me that the manna was caused by the *Galang-galang*, their name for the Australian Tettigonia.'

"The subject is also mentioned in Periera, from which the following is taken :—

"'Manna Tamariscina, called also Manna Israelitarum, and believed by Dr. Landerer to be the manna mentioned in the Old Testament. He informs us that this exudation is produced through the puncture of *Coccus manniferus*, an insect inhabiting the trees of the *Tamarix mannifera*, which grow abundantly in the neighborhood of Mount Sinai. The manna exudes as a thick transparent syrup, covering the small branches from which it flows. It is collected by the monks of the district during the month of August. The collection takes place very early in the morning, at which time, owing to the coolness of the night, the saccharine juice has become to some extent congealed. Later in the day the solar heat causes it to drop upon the ground. It is usually stored away in large earthen vessels, which are preserved in cellars during the entire year. This tamarisk manna is sold in little vessels of tinned iron to persons who visit the monasteries of Sinai. Landerer purchased one of these of a pilgrim, and he found the manna to consist of a yellowish granular syrupy mass, very sweet, and intermixed with the small leaves of the tamarisk. It was soluble in water and alcohol, and the aqueous solution readily underwent fermentation.

"'The alcohol obtained by the distillation of this fermented liquid had a peculiar odour, resembling that derived from the fruit of *Ceratonia siliqua*, which contains butyric acid. The saccharine principle of this manna must, therefore, be a sugar, and not mannite. The tamarisk manna is eaten in Palestine, and in the district of Sinai, as a delicacy, and is reputed to be efficacious in diseases of the chest.'"

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QUEENSLAND PHILOSOPHICAL SOCIETY.

THE annual meeting of this Society was held on the 21st ultimo. Mr. COXEN, Vice President, occupied the chair. The Secretary read the following report of the Society's proceedings for 1869:—

"In presenting the Annual Report for the year 1869, the Council have to congratulate the members of the society on its condition and prospects.

"The last annual meeting, owing to circumstances which were unavoidable, was held late in the year (on the 23rd of April), consequently the Society's operations for the current year have been confined to a period of rather more than seven months.

"During that time thirteen new members have been admitted, and the total number now on the roll book amounts to thirty, exclusive of the names of many who, though still resident in Brisbane, have ceased to take any interest in the society's proceedings.

"The collections of the society have been enriched by the following additions by presentation, loan, or purchase, the thanks of the Society having been in each case forwarded to the donors, or otherwise suitably acknowledged.

"A valuable collection of native birds from Cape York has been purchased with the promise of future additions. The skins require setting up, but the society may be congratulated at possessing them at so moderate a cost.

"A very valuable collection of Australian shells has been lent by Mr. Coxen, the vice-president, and arranged by him in the cases now in the society's museum, to form the nucleus of a larger future collection.

"A case of British butterflies has been presented by Mr. Dobree; a collection of Australian birds' eggs by Mr. Millar; a perfectly white skin of a small species of kangaroo, by Mr. Chapman—supposed to be unique; a two-handed native sword, by Mr. Burrowes; 'Life, its Nature, &c.,' by L. H. Grindon, by Mr. Tiffin; hand of a mummy, by Mr. D. M'Connel, of Cressbrook; some stereoscopic slides of views on the Gilbert, taken by Mr. Daintree, presented by the Minister for Works; also, a number of interesting geological specimens from the Gilbert and Gympie Districts, by the same gentleman; sundry small specimens of native copper, by Mr. Pettigrew; copies of the maps and reports by the Government geological surveyors have also been laid on the table through the instrumentality of Mr. Wight.

"The papers read before the society during the year have not been numerous. Dr. Bancroft has contributed a paper on 'Coccus insects of different varieties,' with a description of their several habitats and products; also a paper describing a new instrument for application in cases of snake bite. Mr. Scott read a paper on 'The sun, a neglected source of power;' and Mr. G. Wight, 'On some unclassified mental phenomena.'

"At one of the monthly meetings, a very interesting letter from Professor Max Müller, of Oxford, to our President, Sir James Cockle, was read by His Honor, on the extreme desirability of taking every means to preserve any portion, however small, of the native dialects when it was possible to obtain them, and urging the pursuit of these enquiries in an organised and systematic manner by the Government. The letter was ordered to be inserted on the society's records, and appears at the foot of this report. Several new books have been added to the library, and some of the serials and periodicals have been bound for better reference. A catalogue is being compiled for the use of the members.

"In conclusion, the council and officers wish to remind their fellow members of the real objects the society has in view—viz., the collection of facts bearing upon natural and physical history, more particularly of this portion of the Australian continent, and of specimens of every kind as affording proof and corroboration of the facts adduced. The intelligent interest of all is earnestly requested to these objects, as tending to advance, not merely the material prosperity of the colony, but the increase of that knowledge of Nature and her laws which it is one of our highest privileges to acquire."

Letter from Professor Max Müller to Sir James Cockle, F.R.S.

"Park End, Oxford, March 21, 1869.

"Sir,—Please to accept my best thanks for the articles on the Australian dialects, which you had the kindness to forward to me. Though at present I am engaged in a different work, and have no time for the study of these outlying provinces of human speech, still I am delighted to see the accumulation of material for further study, and I have no doubt that sooner or later important results will be gained from these apparently insignificant lists of barbarous words. Among barbarous races like the natives of Australia the only monument of antiquity is their language, and it is here, if anywhere, that the historian may hope to dis-

cover some traces of their past, some evidence of their intellectual capacity, some proofs of their connection with other races of mankind. It seems to be the duty of the Government, particularly when dialect after dialect of the Australian language is fast dying out, to collect with real care what can still be saved out of this sinking wreck of humanity. What should we give now for a list of words collected from the mouths of the Etrurians or Carthaginians, aye, even of the Scythians or Vandals. Such lists would tell us more than the mute monuments of Etruria and Carthage; more than the vague accounts of Herodotus or Jornandes. The problem of the origin and ethnological relationship of the first settlers in Australia is of greater importance to the student of the ancient history of mankind than the question whether the Etruscans were of Aryan or Semitic origin, whether the language of the Scythians was Aryan or Turanian; and I feel certain that the names of those who by a patient and careful collection of Australian vocables enable the student of ethnology, it may be a hundred years hence or more, to determine with scientific precision the original descent and the earliest migrations of the inhabitants of that island chain between the two great continents of the world will be remembered with the same gratitude with which Grimm quoted the name of Dioscorides for having left us a meagre list of Dacian names of flowers, or the name of Ulpitas for having translated the Bible into the barbarous jargon of the Goths. Names of places, mountains, rivers, proper names, names of clans (if possible, with their original meaning), the words of every-day life, pronouns, numerals, perhaps an outline of grammar, and some description of manners, customs, superstitions and religion—all this, though apparently mere dross, would turn out to be precious metal if properly tested, sifted, and melted by experienced hands.—I have the honor to be, sir, your most obedient servant,

"MAX MULLER.

"The Hon. James Cockle, F.R.S., Chief Justice, Queensland."

The members then proceeded to the election of the council and officers for the year 1870, with the following result:—President — Sir James Cockle, F.R.S., Chief Justice; Vice-President—Mr. C. Coxen; Treasurer—Mr. A. Raff; Curators—Messrs. S. Diggles and W. H. Miskin; Council—Drs. Waugh and Bancroft, Messrs. S. Griffith and G. Wight; Secretary —Mr. J. S. Gray.

The meeting then adjourned to Thursday, 13th January instant, on which occasion the President delivered the following address:—

My thanks are due to the society for honoring me with a re-election to this chair, and for the consideration shown in permitting me to defer this address. I may seem to have the less excuse for the delay, inasmuch as the society has indulged me, on more than one occasion, by allowing me to leave the duty altogether unperformed. The task is not an easy one, and I could have wished that our excellent vice-president, Mr. Coxen, had consented to undertake it. A certain sameness of tone is likely to pervade successive addresses made by one person, who is perhaps apt to draw his topics and illustrations from sources which may be more interesting to him than to his audience. The present state of the society I leave to be gathered from the report. Not being one of its founders, I may be pardoned for saying that I think gratitude is owing to those who established this association. Such a body, though in a young community it cannot anticipate a rapid progress, or very striking immediate results, supplies a want, and may cherish a reasonable hope of future usefulness. Similar societies exist, and I hope flourish, in several, if not all, of these colonies. I learn from the inaugural address of the Rev. W. B. Clarke, that the Royal Society of New South Wales commenced in 1821, as the Philosophical Society of Australasia, and in 1850, after a long interval of silence and inactivity, it came out as the Australian Philosophical Society, till in 1856 it became represented by the Philosophical Society of New South Wales, merging itself on May 1, 1866, in the Royal Society of New South Wales. Many of the remarks in that interesting address are applicable to ourselves, and the obstacles to any very rapid progress are probably the same here as in the parent colony. It certainly is encouraging to learn that the society of New South Wales has, under various names, survived the vicissitudes of nearly half a century. I shall extract a passage or two from Mr. Baker's address. "We have seen," says the vice-president, "that our province is not in the mysterious labyrinth of mental speculation. We need not, therefore, trouble ourselves with any questions of that class. We have before us in this colony a vast region, much of which is still untrodden ground. . . All that we have to trouble ourselves with is the right interpretation and developement of these physical riches, so bountifully spread around and beneath us for our investigation and use." I long since and from this chair insisted on the opportunities which, as a field of observation, a new country offers. By availing ourselves of these advantages we may obtain results, not interesting and important to ourselves only, but interesting and important to the world at large as well as to the world of science. It must be confessed, however, that communications on such subjects have not been so frequent as to enable us to dispense with contributions of other kinds. In fact there have been times when our society seems to have languished from a dearth of subjects of discussion, and when, as I think I may venture to say, any paper on any scientific or philosophical subject whatever would have been warmly welcomed. It may be a question whether our range is not too limited rather than too wide. I recollect that some time ago, at a meet-

ing of this society, when a slight change of its title was under consideration, the late Mr. Warry strongly urged that it should be called a literary and philosophical society. This suggestion was not adopted, but whether for the reason that the literary ground was already occupied I am unable to say. Of course I do not affect to bind the society by such utterances, but for myself I would remark that, for the present, the wider our scope of subjects the better, and that we should not be over anxious to draw subtle lines of demarcation between art, literature, science, and philosophy, if indeed any line can be drawn between the last two. Diverse as are our mental pursuits and tastes, this society is fortunately untainted by any cliquish spirit. Religious questions we avoid, and the profession of a religious creed is as little a condition of, as it is a disqualification for, admission here. It is possible that this attitude in reference to religion may cause many to look coldly or unfavorably on us and our objects. Some estimable persons may think that our neutrality is objectionable, and others may even entertain the notion that science and philosophy are in general antagonistic to religion. But surely mere neutrality ought not to be allowed to operate to our prejudice. There are questions, deeply interesting to such persons, on which it is not alone the tongue of scientific bodies that is silent. If such neutrality be a ground for regarding us with disfavor, the like disfavor should extend to banks and other mercantile corporations or to railway companies, bodies from which no man yet, that I know of, has held himself aloof on the ground of their theological impassiveness. But, it may be objected, science ignores the possibility of those supernatural interruptions of the course of nature, of those miracles and prophecies which so many regard as the befitting attestation and evidence of a divine revelation, The physicist may retort "You also ignore them. In the conduct of your affairs are you influenced by the expectation of any such occurrences ?" Probably most such objectors would reply in this fashion, "I am a firm believer in miracles, but the miracles in which, I believe, were wrought for an adequate end. I do not think that the course of nature is interfered with indiscriminately or even frequently." Then how far do the disputants disagree ? The physicist is no more to be blamed than the objector, when he takes for granted the existence of permanent natural laws without which science—that is to say, systematic knowledge, would be unattainable. Still, I am not sure that such objectors as I have alluded to are fully answered. And, although in the skirmishes between religion and science religion has been sometimes the aggressor, I feel bound to say that in the present case the aggression has commenced on the part of those who range themselves on the scientific side. The phrase "laws of nature" is sufficiently expressive, and, if we remember that the word law is used metaphorically, sufficiently accurate. But some persons prefix "immutable," and speak of the immutable laws of nature. Now, it is one thing to prefix an adjective, and another to add to our knowledge, and the former is the easier task. If by saying that the laws of nature are immutable nothing more is meant than that, within our individual experience, and that of all credible persons with whom we are acquainted, confirmed by the experience and events of the present and past ages, so far as they can be ascertained, those laws have been unchanged, then the prefix "immutable" does not add to our stock of knowledge. The idea of permanence is associated with the phrase laws of nature, if not actually implied in it. Again, if it is intended to be said that no means of changing them is known to man, and that no human agency has ever changed or interrupted their course, the expression is unobjectionable, except perhaps for its ambiguity. But if, in terming the laws of nature immutable, it is meant to be asserted, either that those laws are unchangeable by any agency whatever, or that, apart from any agency, the laws of nature must of necessity, and throughout an unlimited future, remain the same as they now are, physical science, as I understand it, gives no warrant for the assertion. That such an assertion might wound religious susceptibilities would not be a reason for rejecting it, if it rested on sufficient grounds. And I animadvert upon it, not as assuming to interfere in the disputations of theological or other sages or sciolists, or as seeking to withdraw one of their many bones of contention, but as attempting to remove a misconception, which may exist in some minds, as to us and our objects. We ought not to be subjected, even to baseless prejudice, for doctrines which the society, as a body, certainly does not hold, and which perhaps none of its members hold. The conviction of the existence of laws of nature does not rest upon grounds of consciousness, or intellectual intuition, or pure thought, but upon that instinctive belief in the permanence of sequences which is common to man and brute. The furtive dog appears to recognise theft and lash as members of a permanent sequence, and refrains from the antecedent through dread of the consequent. He shapes his conduct by his observation, and may even be led to seek new fields of less painful experience. His mental organisation is the seat of an instinctive belief in sequences, which, though it may sometimes mislead him, is his only clue in the mazes of experience. But it is in man, of course, that we find the best illustrations of the direction and misdirection of this instinctive belief. One curious instance of its misdirection has come under my own personal notice. A young child, awakening after daybreak, prematurely disturbed the parental re-

pose. An order, to go to sleep again, elicited the question, "If I go to sleep will it be dark again?" The child was inclined to regard the sleep and the darkness as a permanent sequence, and the tendency of the instinctive belief to come into play is manifest. But there is recorded the yet stronger example, of a child asking why going to bed at night makes it grow light in the morning? Here, the instinctive belief in the permanence of sequences had evidently misled the child. The inference is, that a thing instinctively believed to exist may yet have no existence, and that our instinctive beliefs, like our more complex beliefs, are liable to error. This instinctive belief, without which experience would be useless, this wondrous faculty, prephetic in its character, and enabling us to predict the future from observation of the past, is a light to lighten our eyes, but not an infallible guide to our judgment. All that we can say of these beliefs is that they exist, and that the course of nature is in accordance with them. But this is a very different thing from saying that the laws of nature are immutable, and that their violation is physically impossible. Strictly speaking, the term impossibility should be confined to the domains of logic and mathematics. There is no such thing as physical impossibility. All physical knowledge is primarily (for I do not speak of deduced physical knowledge) derived from experience, and what a past experience has affirmed a future experience may disaffirm. There is indeed one mode of seeming to establish the immutability, viz., assuming that future experience will always coincide in its results with past experience. But that is simply begging the question. The society will not misunderstand me, or imagine that I am calling in question the laws of nature, or the legitimate conclusions of physical science. My object is to guard against the laws of nature being supposed to teach what they do not teach, that is to say, their own immutability, necessity, and eternal duration. To say that they are immutable by any agency, is to say that science has disclosed to us all the agencies in the universe. To say that they are not merely existent and actual, but necessary, is to say that they are independent of experience and have the same characteristics as mathematical truth. But the reverse is the case. When we say that the three angles of a triangle are together equal to two right angles, or that a prime number can be found greater than any given number, however great, we say that which not only is true, but which cannot but be true, which is not derived from experience, which connot be demonstrated by any experience however numerous the experiments, which cannot be contradicted by experience, and which is totally independent of experience. Mark the contrast with the laws of nature, and consider one of the simplest of them. The child who regards sleep and darkness, or going to bed and daylight, as permanent sequences, does not err more than Aristotle in his gropings after that law now known as the first law of motion, and, like children, successive generations of men have to correct their first impressions by experience. All our knowledge of nature is derived from experience, and experience can only teach us what is, or has been, and what may and probably will be; not what must be and cannot but be. Then, again, as to the eternal duration of the laws of nature. Here I shall quote from one who, to my mind, is the greatest metaphysician, as he certainly is one of the greatest mathematicians of this age. "A clear view of the usages of nature must, of course, existing up to a certain point be augmented by reflexion, or further experiment, or both, up to a higher point; but no length of usage gives any odds in favor of the impossibility of the contrary." And, in a foot-note to another passage De Morgan says, "If the laws of nature should continue unaltered until noon, the additional half hour will add a trifle to the force of their data. But the theory of probabilities, the only protector from false conclusions in such a case as the present, gives it as an undoubted result that, no matter how many our observations of permanence from moment to moment may be, so long as they are finite in number, we cannot, from these observations alone, draw any probability, however small, in favor of an unlimited continuance. Except by knowledge of continuance *ab infinito*, we cannot acquire any well grounded faith in continuance *ad infinitum*, from any observation and reasoning grounded on that observation alone." I like the phraseology of De Morgan, and I think that the term usages of nature is at once more expressive and more accurate than laws, and less likely to conjure up the tiresome phantoms of immutability, necessity and eternal duration. Let us be content to say, such and such are the usages of nature, and we believe them to be permanent for all the purposes of our experience. But let us never lose sight of the fact that we have only moral, not mathematical, certainty of their permanence. Other than moral certainty is not, scientifically speaking, attainable unless with reference to a mathematical or logical subject matter. And moral certainty means no more than a high degree of probability, though it may sometimes be so nearly equivalent to mathematical certainty as to be arithmetically undistinguishable from it. I will give an illustration, but with greater circumlocution and complication than would be necessary if I were addressing an exclusively mathematical audience. And if to some it may sound strange to hear the laws of nature spoken of as highly probable sequences, they must remember that the probability spoken of is so high as to be properly termed moral, as distinguished from mathematical, certainty,

which last it may indefinitely approach. Next, for the illustration. Suppose that somewhere behind and near an opaque vertical screen, many times larger than the target, a vertical target is placed. The target may be any how placed, provided that no portion of it project beyond the edge or edges of the screen, the object of the arrangement being that the marksman may be in entire ignorance of the position of the target. Now, assuming that the marksman is sufficiently skilful to hit the screen, and the velocity of the ball sufficiently great to enable it to pierce both screen and target, what is the chance of the centre of gravity of the ball passing through the centre of gravity of the target? I select the centre of gravity in order to define the points, and not on account of any physical or other property of that centre. The answer is, that the chance is infinitesimally small, smaller than any assignable fraction however small; that the probability of throwing aces a million times consecutively, with unloaded dice, is an enormously large probability compared with the chance in question; that, were our senses and instruments capable of determining whether the conditions were fulfilled, a gambler, however wealthy, might safely offer any odds whatever against the event, and be morally certain of winning. Then it may be said, why distinguish between such an enormous probability, such a moral certainty of winning, and a mathematical certainty of winning. The answer is that, do what we will, we cannot get rid of the bare possibility, infinitesimally small though it be, of the event happening. So it is with the laws of nature, so it is with every result of experience. Behind their moral certainty, behind what may seem to some their mathematical certainty, there lurks, visible enough to those conversant with the theory of probability, a bare possibility, the analogue of that just pointed out, which forbids him to attribute to any such law, or any such result, either immutability, necessity, or eternity. But, it may be said, if you make the permanence of the laws of nature rest upon mere belief man has no more assurance of that permanence than the hypothetical dog whom you have imported into the discussion. Perhaps not; but man has mathematical and logical faculties, and, borrowing from experience the three laws of motion, and from observation the data requisite for their application, he can so apply them as to extort from planet, and satellite, and comet the secret of its movements. The canine sharer of the belief has not, or does not manifest more than a rudimentary development of such faculties, and does not appear to concern himself with such questions as—Whence arise these instinctive beliefs? Why is the course of nature conformable with them? What is the connection between the belief and the law? Is there any connection between the members of a natural sequence, beyond that of permanent antecedent and consequent in time? If there is, what is the connection? Is it material or not? These, and perhaps other questions, the human inquirer puts to consciousness. But consciousness has not, that I am aware of, given as yet any answer entirely satisfactory to all inquirers. And perhaps it is not to consciousness or to science that we must look for an answer to such questions. Some philosophers, not content with having reasonably ascertained that every known change has an antecedent, and then, by a process of induction, proceeding to the general proposition that every change has an antecedent, take a more ambitious flight. They contend that the true proposition is, not that every change has an antecedent, but that every change *must* have a cause—that is to say, cannot but have a cause. They thus impress, or seek to impress, a character of necessity upon the relation of immediate and unvarying antecedence. There is no ground, satisfactory to me at all events, for giving to the proposition this character of necessity. If the proposition rests upon instinctive belief, then for reasons already given, I think it is, not only superfluous, but absolutely incorrect, to give it such a character. And in order to steer clear of theories of causation, of causal judgments, and the like, I have used the phrase permanent sequence (meaning thereby immediate and unvarying antecedence and consequence) instead of cause and effect. But, whatever be the views of the members of the society on theories of causation, they will, I hope, pardon me for attempting to detach or explain away an epithet which has sometimes been, in my opinion unfortunately, applied to the laws of nature—that of "immutable."

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QUEENSLAND PHILOSOPHICAL SOCIETY.

ON RAILWAYS.

The following paper was read at the last meeting of the Queensland Philosophical Society by Mr. William Pettigrew :—

The subject of Railway communication is occupying a large amount of attention at the present time, not only in Queensland, but in every civilised country.

Railway communication is a very desirable thing, but it can be obtained at too great a cost.

In New South Wales, for instance, the railways there made cost the country £500 per mile per annum, over and above their earnings, and it is said that ours are in a similar position.

Believing that railways can be made and wrought that will not only pay working expenses, but interest on capital, I have, therefore, put my ideas into shape in this paper, so that they can be fairly examined.

In designing a railway between two given points it is of great importance to take the straightest and most uniform line. A survey of the line is absolutely necessary. Various considerations enter into the question as to what is the best line, but I will only make the following remarks further on this point.

The amount of traffic and the nature of it will determine the rate of speed required. As a rule, the greater the speed the more costly the railway. By adopting, in the first instance, a low speed, the first cost is kept down; and also in working, the working expenses in tear and wear and maintenance of line are kept low. In any lines at present required in Queensland—the one between Ipswich and Brisbane perhaps excepted—a maximum speed of eight miles per hour is amply sufficient. Compare that with a bullock-team going at a rate of ten miles per day, for an average of twenty days, equal 200 miles. And that be it observed can only be done under the most favorable circumstances. During wet or showery weather they can only move two or three miles, and sometimes cannot move out of the spot for days, and even weeks together. Whereas, with a railway, as I now propose, a train could do the distance of 200 miles in two or three days as required. It is the certainty and economy of communication, not the great speed that is required.

In order to have as little expense as possible in cuttings and bankings, I would have the bottoms of the longitudinal sleepers to rest on the natural surface of the ground, and the cross sleepers to be sunk into the ground. In crossing flats, liable to inundation by large floods, the longitudinal sleepers should also be sunk into the ground, and only the rails left above the surface, thereby preventing their being disturbed by floods washing the soil from about them. During the time of floods no trains could pass along, but so soon as they subsided the traffic could be resumed, whereas at present the roads are seldom fit for traffic for a week or more after a flood subsides. As to gradients and curves, I would keep the line as straight as possible, so as to prevent a useless expenditure of power in going round curves and grinding the rails and wheels to pieces, and would prefer going more up and down inclines, as I am informed by a railway contractor of great experience (Mr. Fountain), that a horse can draw a loaded truck up an incline of 1 in 25 on a straight line as easily as up 1 in 70 on a curve of seven chains radius. As to the limit of steepness, I believe that a train can be run as safely up or down an incline of 1 in 12 (which is the steepest over the Alps) as on 1 in 50 on our present railways.

Proper designs and careful men are all that are required. The driver must be complete master of the train, and to be safe ought to have at his command four times the power required to stop it. That such inclines are practicable, there is the fact of the railway over the Alps on one system; and, a short time ago, Mr. Dalrymple's traction engine drew three loaded waggons, weighing with their load twenty-one tons, up an incline in Margaret-street of 1 in 9½. I do not consider that there is any occasion to have such very steep inclines on any railways at present required, but if so, there are the means to get up them. This I shall refer to subsequently.

With reference to the positions of bridges, they should be put where the banks are not

liable to be washed away from them. If in a flat, the lower side of the timbers of bridge ought to be above the level of the banks of the creek, so that the creek will overflow its banks before it touches the bridge.

After determining on the line by plans and sections, and marking the line on the ground, there would be the clearing and forming by cutting and banking the line. As already remarked, I would have as little of this kind of work as possible, and let the fuel account be a little heavier.

I now come to the distinguishing feature in the line I would propose. It should have longitudinal sleepers, hewn or sawn on top and bottom sides, the sleepers laid breaking joint—that is, the end of one sleeper opposite to middle of other sleeper, and to have cross-sleepers at these places, thereby making a cross-sleeper for every longitudinal sleeper. The cross-sleepers should be sunk into the ground, and the longitudinal ones laid on the surface, except in flats liable to be flooded, as already referred to. These sleepers should be pegged or otherwise fastened together. Ditches or drains would have to be made, so as to keep the ground dry. As to ballasting, I would have none of it. If the line were for horse-traction, a planked path would be required, otherwise a metalled path ; but unless in peculiar circumstances a planked path would be the cleanest and most durable, if not also the cheapest. Its cost would be about £200 per mile, of 20 inches wide and 2½ inches thick.

As to rails, whether of wood or iron, wooden rails are the cheapest in first cost, and for horse traction would last a long time. At the Dundathu sawmills there is a railway laid down somewhat as I now propose, which has been in operation for seven years ; the original rails in some places are still in use, but are reduced about an inch in thickness. The traction on wooden rails is certainly double that on iron rails, so that item might somewhat determine whether wood or iron should be used. Wooden rails ought not to be wider than face of wheel, say two inches, or say 2 x 2. Iron rails would do if weighing 20 lbs. to the yard ; that would require 31 tons to the mile, at £10 per ton, equal £310. The rail exhibited is 28 lbs. per yard, and would be 44 tons per mile, at £10 per ton, equal £440.

SAWN TIMBER.

In some places where suitable timber cannot be got for hewing into sleepers, or where there is no timber at all, it would be requisite to bring sawn timber by rail to make the railway. The longitudinal sleepers and cross-sleepers would be quite strong enough if made of plank 10 inches wide by 3 inches thick and 20 feet long. I have adopted the length 20 feet because rails can be readily made that length and there is abundance of timber to be got of that length, and if of 30 feet they could work into the rails. The end of rails I would have laid at 5 feet from end of sleepers, thereby making a break of joint different from that of sleepers, and ensuring great lateral stability of railway. I annex an estimate of a railway of hewn timber and of sawn timber. In sawn timber I have taken the price at 15s. per 100 feet, which I consider is a safe calculation. If a portable sawmill were put on the railway, I believe that the sawn timber could be got for 10s. per 100 feet, or less, as the drawing of the logs would be a very small item. The wooden rails I have put down at 20s., because I would have them of spotted gum, or ironbark, they being the most suitable for the purpose, and might not be growing near where they were required.

FASTENINGS.

As to fastening the cross and longitudinal sleepers, where they are of logs, they might be notched, and fastened with wedges, or treenailed. Where they are of sawn timber, 10 by 3, treenailing would be best. In fastening the wooden rails, 2 by 2, to the longitudinal sleepers, ironbark pegs, about half-inch in diameter, would be best. In fastening the iron rails to sleepers, I would use ironbark pegs, about one inch diameter, and having conical heads, about 1½ inch greatest diameter—these to be driven in slightly beveled. If anything further were required, it would be at the ends of rails, and that could be done by having pieces about 2 feet long, 3 by 1½, pegged on each side thereof. Iron makes bad fastenings. It eats the timber, and the timber eats it. It first sets fast by rust, and the rust eats the iron through. If the iron loosened in the hole it could not again be made fast therein. Whereas with wood all that is required is a larger peg. This, however, is a question that could only be tested by experience. If iron were used a round pin ½ inch diameter, with bent head, would do. If the hole it was driven in was 1-16th inch smaller it would soon set fast with rust.

BRIDGES.

It appears to me great folly to bring iron from England to erect bridges of when we have abundance of the finest timber well adapted for such purposes here. Our ironbark, on account of its straight grain, strength, and durability, stands unrivalled. Other timbers to which reference will subsequently be made are also very good. Referring to model bridge on table which represents a length of eighty feet on scale of ¾ inch to foot, one truss was made some years ago when a piece of the Brisbane temporary bridge was carried away by a flood. The other truss was lately made, is of a lighter scantling, and put together in a better manner, besides being a better design. The beams are placed with their flat sides up. This arrangement gives a large amount of bearing surface at ends of pieces, thereby making it firmer and not so liable to warp. The pair of trusses are kept in their position laterally by the two triangular braces. It is impossible to make a bridge of this description without using iron for straps and bolts ; but to prevent their destruction I would give the straps and bolts two coats of paint before being used ; also to have the same done to the wood where they are in contact. I am not sure, but it might be economical to have an

iron roof over such a bridge, but if not, it would require painting to keep the water out of the joints and ends of timber.

MOTIVE POWER.

As to the motive power, horses or engines, from evidence taken in New South Wales on cheap railways I find that a horse can draw on a railway as much as six or eight on a good macadamised road; also, that on a line in Europe, over which 22,000 tons were conveyed in six months by horse, it cost 1d. 1·6th per ton per mile, and by engine it cost about ⅔d., being rather more than half the cost of horse traction. The engine only wrought 2½ hours per day doing the work—about 140 tons per day. Where a railway is only of a short length—say four or five miles—I believe that horses are the most economical for a light traffic; but as in this country, where the lines have to be laid, not units, but tens, and hundreds of miles, the iron-horse must do the work. Engines are made in various manners, by different makers. They are mounted on four, six, eight, or even more wheels—according to their weight; the object being to have only a certain weight—four or five tons—on each pair of wheels, according to weight of rail. Now, for our slow speed and light rails such engines are entirely unnecessary. I would have engines purposely built for our requirements, weighing about eight tons. I would have them double-geared —that is, the crank shaft should have two pinions, one of which to gear into driving-wheel, and making three or four revolutions to one of driving-wheels; the other pinion to gear into intermediate shaft, and when in it crank shaft to make about 12 revolutions to one of driving-wheels; this second motion I would use on steep inclines, say of 1 in 20, and in order to have traction power I would have a separate wheel, with wooden teeth (spotted gum), working into a rack placed midway between the rails. Two of such wheels would be required; one by which to ascend (in which the pitch would be coarser than that of the rack), and the other by which to descend (in which the pitch would be finer than that of the rack),

Another plan would be to have a tire of vulcanized indiarubber, as on the traction-engine of Mr. Dalrymple, on a middle wheel, and let it rest on a plank between the rails.

The cog system might not be the cheapest at first, but the working expense would be less with the rubber. An engine of eight-horse power, with modification as above, could be made for £1000, or less.

As to the goods carriages for such a line, they could be made here out of our indigenous timbers, as they are far stronger and more elastic than any that can be imported. For all the springs that would be required for them, our spotted gum would do. The wheels, axles, and bearings, with other iron work, would have to be imported.

It is only by comparison that the advantages of another plan than the one adopted can be appreciated. We have a costly railway now at work. From a report to the Legislative Assembly in 1868, I observe that the repairs to the line from Ipswich to Helidon was £220 per mile per year, and on the Main Range was about £290. In that was included some land-slips, &c. Now, by my plan of railway it would be next to impossible that much over one-tenth of such sum would be required for repairs unless some bridge was carried away altogether. Referring to the Main Range portion, which by map appears to be a series of curves, and the inclination about 1 in 70, I have already remarked that a horse can draw as much on a straight line up an incline of 1 in 25, as he can draw on a seven-chain radius curve, and up incline of 1 in 70. So that, could a straight line have been got up there with inclines of 1 in 25, it would be in the same position, so far as drawing-power is concerned, as our present line, and less than half the distance would have to be passed over, and therefore less than half the power and cost in taking of goods up or down. Over and above that there would be the saving of keeping the straight line in repair, with low speed against the present crooked line with high speed, also in keeping the engines and carriages in repair. These items of saving would certainly amount to 70 per cent. on this portion of the line. I cannot find out what are the expenses attending working this portion of the line; at any rate, it must be enormous, and the saving that would be effected by making a short, straight, steep line would cover the expense of making it in a few years—say four or five years. This portion of line from Helidon to Toowoomba is twenty-nine miles, and by dray road is fourteen miles.

I have referred to 1 in 25 as a comparison, but there is no reason why 1 in 10 should not be adopted, if required. In New South Wales evidence, one engineer says cogs are very dangerous for a railway. One story is good till another is told. I say unhesitatingly that I see no danger attending them if properly made, and with two wheels—one by which to ascend, and another by which to descend. I have cogs extensively in use at my mill, and only once were they stripped. I have a wheel at present in use off the fly-wheel, in which the cogs are worn to an edge for one-third the length of tooth. The pitch is 2½ inches; power taken off, about 12-horse. I intend to let it run till the teeth break.

As to keeping such a line as I now propose in working order, the expense for repairs would be very little indeed. The present railways are always liable to get out of gauge or shift their position, as the fixings to hold the rails laterally are very little; whereas with one now proposed it is nearly impossible for it to get out of shape in this manner. Then for getting off the level, the whole length of a pair of sleepers and a cross-sleeper would have to shift; whereas with our present railways the only thing to keep the rail level is the strength of the rail itself and isolated sleepers. Another thing in hot weather is the expansion of the rails; and there being sometimes no room for them to expand, the whole line goes out of shape; whereas with plan now proposed, there being no chairs, the ends of the rails can easily be kept clean, so as to allow room for expansion.

DURABILITY.

The durability of such a structure depends on the timber used. The oldest piece of timber that can safely be pointed to as having been on the ground for a long time is a piece of bloodwood now lying in Mr. Thos. Petrie's paddock, North Pine River. About 1824, while the settlement was at Umpy Bong, a party in a boat went up the Pine River and landed, and began to cross-cut the piece of timber referred to, and also chopped it with their axe. While doing so they were attacked by the blacks, and they then left. The limb is apparently sound; the tree from which it fell is still growing. The mark of the axe is still distinct upon it, although the time is about 46 years ago. The next is a fence opposite my dwelling-house, put up in 1842 or soon thereafter—that is 28 years ago. It stands, but is somewhat decayed. I may then safely say that a railway constructed of bloodwood, ironbark, or spotted gum will last thirty years, and that it may last sixty years. These I consider are our three most durable timbers; bloodwood, however, cannot readily be sawn, it could only be used in log and hewn. Our next best timbers are blue gum, turpentine tree, black-butt, and stringy-bark. These are all that I at present know that I could recommend to be used in railway making, and the best are placed first. I have been spoken to about using our timber in the same way as they do in America in making wooden railways,—namely, by using good sized pieces of scantling for rails, cutting notches in cross-sleepers and fastening with a wedge. I am not going to say that it could not be done, but I do not look on it as being economical. Our best timbers all spring in cutting, and to cut them straight they would require to be left so large as to allow their being cut twice, and it is a question if, even then, they would be straight. Logs can be cut to advantage as follows:—Cut up the middle with circular saw, then edged and cut straight on back. The centre placed downwards and the straight piece for rail. The next way is for larger timber—with two saws in frame take 10-inch flitch out of centre, the slabs to be edged and straighted on back by circular saw. These would be unequal in thickness. The flitch to be cut up the middle to take the spring out of it, and cut into two or more pieces as it would allow. These pieces would be straight and equal in thickness. The central part of our timber ought always to be avoided, as it is there that it first begins to decay.

BRIDGE.

The model exhibited represents 80 ft. long and 8 ft. wide in the clear. The tie-beams and principal trusses are 12 inches wide, and 6 inches deep. The king-posts are 12 x 8 and 9 x 6. The braces or trusses are 6 x 6. The lateral triangular braces are 12 x 6. The longitudinal sleepers are 12 x 8. The pathways are 12 x 3, and handrails with uprights not shown. The total quantity of timber in the bridge is about 8000 feet.

The whole work, including price of timber, iron work, and time of carpenters fitting pieces together, would cost here about £200; that is at the rate of £2 10s. per foot run. Circumstances would determine in each case the foundations and abutments required.

By published evidence I find that on the Main Range, near Fountain's camp, the iron bridge which buckled, cost £18 per foot, and had it been of timber it would have cost £14 13s. per foot. Bridge No. 50, which is 80 feet long, cost £1280, or £16 per foot. Had it been of timber it would have cost £730, being more than 3½ times the probable cost of this one. I have not seen this bridge or design for a timber one, but cannot fail expressing an opinion that it is very like money being thrown away, and now we have to pay the interest thereof in increased taxation.

The model and the weight 200 lbs., is far more than ever can possibly be put on to a train on a bridge the full size. Mr. Tiffin, Engineer of Roads and Bridges, has calculated the strain, and he states that it is capable of carrying six times that weight. Be that as it may, the present weight, 200 lbs., is ten times the greatest practicable moving load it can be subjected to. The new girder deflects about 1-12 of an inch, and the old one considerably more, not being so well fitted.

ESTIMATED COST OF RAILWAY, WITH HEWN LOGS AS SLEEPERS.

One mile of railway equal to two miles longitudinal sleepers, and if sleepers 20 feet long would require 528 sleepers, and 528 cross-sleepers, 7 feet long.

	£	s.	d.
A pair of men will cross-cut and hew 12 sleepers, 20 feet long, in a day, or 44 days for the mile, at 16s.	£35	4	0
They could do the 528 cross-sleepers in 26 days	20	16	0
Drawing these to their places depending on circumstances—say	40	0	0
Fastening together with 6 pegs to each cross-sleeper, at 2d. per peg	27	0	0
Wooden rails 2 x 2=10,560 l. ft.= 3520 feet, at 20s.	35	4	0
Pegging rails to sleepers, at average of 1 to 2 feet=5280, at 1d. ...	22	0	0
Earthwork, digging holes for cross-sleepers and ditch, or ditches to drain ground—say	200	0	0
Bridges—say per mile on average	200	0	0
	£580	4	0
If with pathway of wood for horses	200	0	0
	£780	4	0
If with iron rails, 20 lbs. per yard, extra	£300	0	0

Thereby making road for horses at £1080, and for engines at £880 per mile.

SAWN TIMBER.

Using sawn timber, 10 x 3, instead of hewn logs for longitudinal and cross sleepers, would require other £200.

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QUEENSLAND PHILOSOPHICAL SOCIETY.

The annual meeting of this society was held on Thursday evening, January 25. Sir James Cockle, F.R.S., presided, and the following members were present:—Messrs. J. K. Handy, W. Pettigrew, B. L. Barnett, H. Starke, S. W. Griffith, A. Raff, C. S. Mein, S. Diggles, J. S. Gray, Dr. Bancroft, and Captain O'Reilly. Two visitors were also present.

After the transaction of the ordinary business, the secretary read the following report of the society's proceedings for 1871:—

"During the past year the meetings of this society have been regularly held, and though few papers have been read by the members, various scientific matters have been introduced, and made the subject of interesting and animated discussion. Among these may be mentioned Mr. Diggles' observations on the newly naturalised insect, Danais Archippus, a very handsome butterfly, indigenous to America, and now the most common and widely distributed of any of the beautiful family to which it belongs in Queensland. Mr. Diggles, in the course of his remarks, was led (from the facility shown by this insect in adapting itself to its new habitat) to suggest that attempts should be made to introduce other fine species of the family which, like it, feed only upon plants of no economical value. This species was common throughout the winter about Brisbane, and all the northern portions of the colony.

"Dr. Bancroft directed attention to the valuable bitter bark obtained from the Alstonia constricta, and exhibited the active principle, which is a body similar to quinine, but differing in its crystalline form and reaction with tests. He had visited the hills near Dalby on which the tree grows, and from the experiments he had made, believed the bark would prove a most valuable antiperiodic and tonic.

"Amongst the various observations of interest, it was shown that the jarra wood of Western Australia, which was supposed to resist the attacks of the Teredo navalis, commonly known as the cobra, was in no respect better than many other hardwoods of these colonies, specimens taken from the hull of the Francis Cadell being exhibited which were completely riddled.

"The society having published the letter received from Professor Max Müller concerning the importance of collecting vocabularies of the languages of the aborigines of Australia, Mrs. Barlow contributed a valuable list of words used by the natives of the Lower Condamine.

"The Vice-President (Chas. Coxen, Esq.) still continues his useful labor in setting up the valuable specimens of birds for the society's museum. The fine collection of shells belonging to that gentleman still continue to adorn the society's room.

"At the request of the Government the society handed over the principal portion of the geological collection, consisting of minerals and fossils. They are now classified and arranged in glass cases in two rooms of the Parliamentary Buildings. These rooms are by no means well adapted for the suitable display of the specimens.

"The society have brought the subject of a museum before Government by a deputation which waited upon the Minister for Works. On that occasion they endeavored to point out the necessity for a building, and the advantages of the original site for its erection—in the unused space of the Botanic Gardens near the guard-house. The plans submitted to the deputation were deemed suitable, being elegant in design and capable of erection at a moderate cost, and also having the valuable qualification of capability of addition to any extent. It is to be regretted that no step has yet been taken to establish a general museum in Brisbane, and that only a mineral collection is open to inspection, as a considerable amount has been spent which might have aided in furthering the erection of a general museum. The deputation informed the Minister for Works that on such a building being provided they were prepared to remove to it their collections of other objects of interest. They also intimated their full conviction that on its becoming known that there was a suitable building erected contributions now often lost would be secured to the colony."

Upon the motion of Mr. Pettigrew, seconded by Mr. A. Raff, the report was adopted.

The society then proceeded to the election of office-bearers for the current year.

The following gentlemen were re-elected unanimously to the offices named :—Sir James Cockle, president; Mr. Charles Coxen, vice-president; Mr. Diggles and Dr. Bancroft, curators; Mr. A. Raff, treasurer; Mr. J. S. Gray, honorary secretary.

A ballot being taken for four members of council, the following gentlemen were elected : —Dr. Waugh, Mr. Pettigrew, Captain O'Reilly, and Mr. S. W. Griffith.

The President then delivered the following address :—

I return my thanks to the society for again honoring me with a seat in this chair, and allowing me to defer until now this, the annual address expected of the President. If we have made no decided progress during the past year we need not feel discouraged. The kindred society of New South Wales had its long interval of silence and inactivity, yet the lapse of fifty years has left it flourishing in unimpaired vitality. I doubt not but that our society will survive similar untoward periods, and that its earlier members will one day be recognised as men who labored, earnestly and successfully, to sustain and perpetuate the oldest scientific institution in the colony. I have also to offer thanks to the society for having dispensed with an address from me on the last anniversary. As it is desired that I should not, on the present occasion, pass over this part of my official duty, I once more fall into a current of thought which runs through my previous addresses, and, indeed, pervaded the few remarks which I made, in lieu of a formal address, at our last annual meeting.

We know what ambiguity lurks in the word law. We have laws of conduct, penal, yet often disobeyed; laws of nature, without penalties, but uniformly obeyed; laws of thought, without either penalty or uniform obedience. Law of Nature is itself an ambiguous term. It may mean natural equity as distinguished from municipal law. It may mean a law of conduct whose penalties are not inflicted by man, as when intemperance is followed by death, or mental or bodily disease. It may mean the usages which the phenomena of the external world are wont to follow; and I have already tried to show that no other scientific meaning ought to be attached to the term. If we allow a metaphor to allure us into the belief that science can lay down immutable courses, with which nature's ways must of necessity correspond, we may be led to undervalue experience and testimony.

And what is experience? Experience in relation to knowledge and apart from its connection with practical dexterity, is the observation and memory—first, of things and states of things; secondly, of events—that is to say, of the changes of things and states of things; thirdly, of sequences—that is to say, of the order in which events have occurred. Experience, therefore, is of the present and past, for, until the future shall have become the present and past, there can be no observation or memory of its things, states, events, or sequences. Then what light can experience throw on the future? None whatever. Anticipation of the future is prediction, not history or narrative. The light is shed by the mind itself, which is so constituted that, whenever two natural events have been observed to occur in a certain order, an instinctive expectation arises that an event like the first will always be followed by one like the second. In strictness, belief relates to the present and past, and expectation to the future, but we shall be exact enough if we say that, in the human mind, and probably in that of animals, there is an instinctive belief in the permanence of every sequence. By this is meant, not that there is an innate conviction of the general proposition that all sequences are permanent, but that, as each particular sequence is experienced, a belief arises that such particular sequence is permanent. Experience corrects the mistakes of instinctive expectation. And one principal use of experience is to teach us to avoid what is false, not to choose what is true. Instinct leads us, quickly enough, to permanent sequences, for it tells us to regard all sequences, permanent or not, as permanent. Experience informs us which are accidental. And experience has her work to do. Thirteen at a table, spilling salt, giving away knives or scissors, death-watches, and the like, will suggest sequences regarded by some, perhaps even in the present day, as permanent.

I think the proposition, that we instinctively regard all sequences as permanent, is sufficiently proved by two instances given in my last address. Another instance* has quite recently fallen under my own observation. Those who associate with young children should notice and record such remarks. In life's young day everything is new and striking. That which the wearied apathy of age passes without notice was, when seen for the first time, an object of eager curiosity. Vivid impressions are made by some sequences, frequent repetition forces others upon the attention, testimony contributes many. Of the mass of sequences the remote are disregarded, the unimportant forgotten, the accidental detected. As infancy recedes, experience gains upon instinct. The importance or the duty of seeking accurate knowledge becomes more keenly felt. But, until he has had time to gain experience, what else can a child rely on than instinct? If he had no in-

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* A child, about four years and three months old, said—"When you light your pipe it does not grow dark" in here. It struck me that she regarded smoking as a prophylactic. The remark was made probably early in the day, certainly long before nightfall. The day, January 8, 1872, was cloudy and gloomy, and, I think, rainy.

stinctive belief in the permanence of sequences he would avoid believing in false sequences, but he would be destitute of belief in true ones. And if he were left to acquire his knowledge by experience what painful, extensive, and discriminative processes he would have to perform before he could distinguish permanent sequences. That the child should be able to bring such processes to a successful issue at all depends upon the assumption that an induction from past to future may be made in the same manner as any other. If this be not admitted, we have to fall back on the instinctive belief. If it be, then the ambiguity in the term laws of Nature would cease. Laws arrived at by induction from usages would probably be admitted to be only condensed statements of usages. If it should be said that the child need not become an experimenter, but might be taught by his parents, or other instructors, then arises the question, How could he be taught unless he instinctively believed his tutors? If he has no instinctive belief in testimony, but has to ascertain its credibility by experience and induction, he is not in a better position than if he had to find out by experiment what sequences are permanent. If he has an instinctive belief in testimony, still experience will have mistakes to correct, for human testimony is not uniformly true.

My purpose is, not to question the instinctive belief in testimony, but to affirm that in the permanence of sequences. Indeeed, proof of either would render the other probable. By an instinctive belief, in the permanence of sequences, I mean such belief in the permanence of all, whether they be actually permanent or not. If the child could distinguish permanent from accidental, he would do what the man, unaided by experience, can not do. When a child asked, "If I go to sleep will it be dark again?" we may infer that she usually went to sleep by daylight, had sometimes awakened in the night, and suspected that darkness was the permanent follower of sleep. When another asked why going to bed at night makes it grow light in the morning, we may infer that it was in the habit of going to bed after nightfall, and believed that going to bed was the cause of dawn. Starting with these authentic instances it might not be difficult to give a plausible sketch of the development of intelligence. The refreshment which awaits him at the threshold of life impresses a sequence, at the accidental disturbance of which the infant shows signs of displeasure. He thinks that going to bed at night makes it grow light in the morning. Testimony, or experience, tells him that it would grow light whether he went to bed or not. Fortunate will he be if instinct leads him into no worse error than misinterpreting a sequence. He puts his finger into a lighted candle, his foot into scalding water, and he tries to get the bait out of a rat-trap. A burnt child dreads the fire, and he recognises the malign sequences as permanent. Sequences, more obviously beneficent, disclose themselves, but he is always liable to mistake. ne day he is taken to a place where anxious-looking men are adjusting what seem to him strange engines. Statements, accurate to the precise instant of time, do not interest him, nor does the monotonous beat of clockwork. He sallies forth. Presently, and amid a cloudless sky, the sun is darkened. He observes that animals recognise the change in Nature's face. What wonder if he should impute her fantastic deviation from the ordinary course to the mysterious instruments, and the eager-looking men? When, in after times, he shall see huge machinery cease from work on the pulling or turning a small handle, and shall attribute the stoppage to the pull or turn, he will only be drawing a similar inference. Soon the child learns that looking at the sun through a telescope does not cause an eclipse, and that fluctuations of the index of a barometer are signs, not causes, of atmospheric changes. One by one he gets rid of false sequences, and assimilates and classifies the true. And, after all, he finds that experience and testimony either confirm the teaching of instinct or effectually restrain the aberrations into which instinct would beguile belief. Advancing years dispel many a charming illusion of his youth, but they disperse its sensuous and intellectual clouds, and, as life's evening closes in, he comes to acknowledge in Nature a gracious and, in the main, truthful mistress, and is content to forgive her at night the sweet falsehoods she told him in life's morning.

That what follows may be clear, let us bear in mind that, of any two events, not simultaneous, the first in order of time is called the antecedent; the second, the subsequent; the two, a sequence. Two simultaneous events constitute a concurrence. Sequences are permanent or accidental, and when any doubt arises experience alone can decide under which category any particular sequence should be placed. Our chief concern is with permanent sequences.

On the question of the efficacy of physical causes to produce their effects I do not enter. I take the w rds, cause and effect, as I find them, without forgetting that the phenomena of Nature are not affected by the names we choose to give them. But it is the office of language to express by words the procedure of thought, and, in seeking to ascertain what sequences ought to be called cases of cause and effect, we may be dealing with things and not with names only.

Let us consider some particular sequences. Night follows day; death follows life; thunder follows lightning; violent atmospheric disturbance follows a great and sudden fall of mercury in the barometer; daylight follows going to bed in the night. All these sequences are permanent, but there is only one of them which can, and that with questionable propriety, be called

a case of cause and effect, and each of the five has its characteristic.

Night follows day. But we do not say that day is the cause of night. As night follows day, so day follows night, and the sequence is reversible, and we have day, night, day, night, and so on in periodic succession. But in such a succession we cannot say that day is the antecedent of night any more than that night is the antecedent of day, for we might with equal propriety write the series thus:—Night, day, night, day, and so on. In such cases we have a cyclical sequence. Thus summer and winter, flow and ebb of tide, are cyclical sequences; and we do not say that summer is the cause of winter, or flow the cause of ebb. One characteristic of many of these cyclical sequences seems to be that we could have no conception of one member of the cycle unless we had a conception of the other. Thus we could have no conception of winter, night, or ebbing tide, unless we had a conception of summer, day, and flowing tide; nor any conception of summer, day, and flow, unless we had one of winter, night and ebb. We might look out on a frozen and darkened landscape, but we should not know it was winter and night unless we knew there was a summer and day. Rising water would not be to us a flowing tide, unless we knew that there was such a thing as an ebbing tide. Liquid lead would not be called melted lead unless lead, unlike quicksilver, was solid at ordinary temperatures. Cyclical sequences point, not so much to a mutual physical dependency of the events, as to their common physical origin.

Death follows life. But we do not say that life is the cause of death. This sequence is not cyclical. We cannot reverse it, and say that life follows death, for life follows birth. The sequence may be termed formal. A thing is not said to be the cause of its own end, nor is the beginning of a thing said to be cause either of the thing itself or of its end. Birth and life, life and death, living birth and death are all formal sequences I think the rule is, that whenever we cannot conceive a material part of either, no matter which, member of a sequence without a conception of a material part of the other, and the sequence is not reversible, then we may call it formal. My reason is, that physical antecedents and subsequents are only known by experience, and are in general utterly dissimilar and without any logical connection. If one member of a sequence is the reverse of the other, or if both only contain one physical conception, this kind of formal sequence may be termed spurious. The light of a meteor momentarily illumines a dark sky. We may call the change from darkness to light the antecedent, and that from light to darkness the subsequent. There are two events, but only one physical object—viz., the light. Inquiry would aim at determining the origin of the light, and not, properly speaking, the connection between the light and the darkness. If the spurious sequence were cyclical, as in the case of any periodic light, research would take the same direction. For a physical cause, we look outside a formal sequence.

Thunder follows lightning. In one view this seems to be an ordinary sequence; in another, a sequence in the nature of a concurrence. If we say that the thunder is audible after the lightning has been visible, we leave open the question, whether we ought not to recur to two simultaneous initial disturbances, having a common source, and from one of which the light, and from the other the sound, was propagated. We may compare the lightning and thunder with the electric spark and snap, which resemble it, and with the flash and report of fire-arms, which are analogous to it. If we come to the conclusion that the initial disturbances were simultaneous, and that, in their inception, the light and sound issued simultaneously from a common source, in the same way that light and heat issue from flame, we ought not to say that the light and sound are cause and effect. Simultaneous or concurrent events indeed cannot stand in that relation, for they lack the beforeness and afterness involved in every definition of cause and effect. Two simultaneous events, though they can have no such mutual dependence, may, or may not, have a common physical origin on which each depends. The shadow on a sundial, and the hands of a chronometer, simultaneously mark the hours. But the motions of the shadow, and those of the hands, have no mutual dependence, and no common physical origin. Again, seeming concurrences may be real sequences. Thus, the rotation of a steam paddle is the cause, that of a waterwheel the effect, of a current of water.

Violent atmospheric disturbance follows a great and sudden fall of mercury in the barometer. But we do not say that the fall of the mercury is the cause of the disturbance. This sequence could be destroyed by causing a similar fall by artificial means, in which case the atmospheric disturbance would not follow. We need not actually try the experiment, for well informed persons would not expect the sequence. Sequences like this may be called destructible, and are in the nature, not of cause and effect, but of mere precursor and principal event. If an instrument were so contrived as to be affected by a north wind only, and to give a conspicuous indication so long as a north wind blew on it, and no longer, the indication might be differently regarded by different persons. To an observer near the instrument the indication would be a sign that the wind was in the north. To one considerably south of the instrument the indication would be precursive. Should the

southern observer suspect that the indication was, not a mere precursor, but an actual cause, of north wind he might, if the instrument were accessible, find that he could make the indication appear and disappear at his pleasure, and that a north wind was not raised in the one case or lulled in the other. But there may be cases in which the instrument is not accessible, and we could not work the indicator if it were. If the telescope were to reveal a sequence, to which no known terrestrial one bore either resemblance or analogy, we could not say whether it was destructible or not. A non-terrestrial observer might see the hoisting of a flag followed by a salute of artillery, without any idea of the nature of this terrestrial sequence.

Daylight follows going to bed in the night. But we do not say that the recumbency is the cause of the light. This sequence is not destructible. It is indeterminate. Of all the acts and events which precede daylight there is nothing to point to this particular one as its determinate cause. No determinate interval of time is assigned as elapsing between the antecedent and the subsequent Every event of to-day has been preceded by the events of yesterday, and of countless yesterdays; and, unless we insist on determinateness, any of to-day's events, grouped arbitrarily with any event of centuries ago, might be presented to us as a sequence. The signs of determinateness will vary with the sequence. Time, place, or any circumstance, may furnish one. The greater our experience, the more keen will be our sense of any indeterminateness. To the child who thought that going to bed caused dawn, probably the sequence seemed as determinate as any other. What other events, he might argue, should occur in the night than going to bed? And as to the event being indeterminate, why it was the last thing he remembered doing; and as to fluctuating intervals, what else could be expected when the people in the house were so irregular in going to bed?

We now come to another kind of sequence. An explosion follows the contact or proximity of red-hot iron with dry gunpowder. This sequence is permanent. It is not cyclical, for no such contact or proximity follows the explosion. It is not formal, for we could conceive of an explosion without having any conception of gunpowder or red-hot iron; and of the contact or proximity without any conception of the explosion. Apart from experience we should no more anticipate an explosion from the contact of red-hot iron with gunpowder than we should from its contact with black seed, soot, or powdered charcoal, or sand. The sequence, not being formal, is not spurious. It is not in the nature of a concurrence, for the contact or proximity precedes the explosion. It is not destructible, for if we wet the gunpowder, or cool the iron, we change the antecedent. It is not indeterminate, for the events happen almost simultaneously, and nearly in the same place, and no other event, than the contact or proximity, has so determinate a relation to the explosion. This permanent sequence which is not cyclical, or formal, or in the nature of a concurrence, or destructible, or indeterminate, is a case of what is called cause and effect, or, say, of causal sequence.

The foregoing remarks are to be restricted to immediate sequences, or we shall deviate from that popular use of the words cause and effect with which it is my object to conform. An immediate sequence is one in which no recognised intermediate event occurs between the antecedent and the subsequent. But the antecedent in the first, and the subsequent in the last, of a chain of sequences, may be stated as a sequence. And such sequence may, on examination, be seen to be mediate. Now a mediate causal sequence, though destructible, is not the less said to be causal. Thus the pulling the trigger of a cocked, capped, and loaded gun, is followed by its discharge. Here we have a series of events—viz., pulling the trigger, release of the spring, fall of the hammer, detonation of the cap, ignition of the powder, and discharge of the missile. At least four events intervene between the pull of the trigger and the discharge, and the mediate sequence is seen to be destructible. Nevertheless it is said that the pulling the trigger causes the discharge. This mediate sequence is neither accidental, indeterminate, formal, cyclical, or in the nature of a concurrence. A mediate sequence may be constituted by other than causal sequences. The mediate cyclical sequence, spring, summer, autumn, winter, consist of four formal sequences.

Experience may be said to inform us that every observed event has a cause and, as we have no sufficient reason for believing that observation of events alters their character, we may advance to the general proposition that every event has a cause. The rule has exceptions, real or seeming. Experience, epitomised in the first law of motion, says that the motion of a free material particle, uninfluenced by impressed forces, is rectilinear, uniform and persistent. The law is silent as to any cause of the persistency. It, indeed, postulates the absence of force, that is to say, of any cause of motion, and regards the movement as a state of the particle, and not as a series of events. If we express the phenomena as sequences we have to say, change of place follows change of place. But this sequence is formal, or even spurious, for, though we have an infinity of events, we have only one physical object—viz., the particle. Perhaps the result of experience, rigorously expressed, is, that every event is the subsequent in some sequence or sequences, and at least one such sequence is causal, except in cases within the first law of motion, or certain other cases of persistency. However this be,

let us remember that the assertion that every effect must have a cause is, though true, only a verbal truth. To dispute it would be to enter upon mere questions of words and definitions. It is an analysis of the conception of effect, in which that of cause is implied. It is but an analytical judgment. But the assertion, that every event must have a cause, is a synthetic judgment a priori. It is a synthesis, or putting together of the independent conceptions event and cause, for no analysis of the conception event seems to disclose the conception cause. It is a priori, for it is not derived from experience, which can only tell us what is or has been, not what will, still less what must be. Comparing the metaphysical proposition, that every event must have a cause, with the physical one, that every event has a cause, we notice that at first sight a single exception would seem to overthrow the former, while it would leave the latter true, save in the excepted case. It might be answered that the metaphysical is more extensive than the physical proposition; that every thing or state, as well as every event must have a cause; that there is no exception; and that, even if the case of the free and undisturbed motion of a material particle, or any other case of persistency, be an exception to the physical, it is none to the metaphysical, dictum; that there is a hyper-physical cause of the persistency of the motion, as there is of the existence of matter itself. The reply might be, that we are now leaving the world of experience behind, and soaring into transcendental regions. But, waiving this, there seem to me to be other objections, not without weight, to the metaphysical dictum. The dictum is a synthetic judgment a priori, standing in isolation. Even if we reinforce it with two synthetic judgments, viz., that a cause is immediately and invariably followed by its effects, and that an effect may be the consequence of any or either of two or more sufficient causes, we seem to be as far as ever from a science of pure cause. In other cases, in which we can obtain one synthetic judgment a priori, we can obtain an illimitable multitude of such judgments and construct sciences; as witness logic, arithmetic, geometry, algebra, kinematics, the calculus and the whole of pure mathematics. The subject matter of the metaphysical dictum is indeterminate, and involves conceptions having no common characteristics. Other synthetic judgments a priori are based upon determinate subject-matter, of which every modification has a common characteristic; as logic upon laws of thought, arithmetic upon number, geometry upon space, and so on. The isolation and indeterminateness of the metaphysical dictum seem to be anomalous. The physical dictum, that every event has a cause, is isolated and indeterminate, but there is no anomaly. Being a synthetic judgment a posteriori, a judgment of experience, it rests, partly at all events, on the experience of which it is a generalisation. What we expect from it is, not a multitude of similar judgments, or a science of abstract cause, but practical applications and illustrations in actual or possible experience. We do not expect to find it determinate, because experience itself is indeterminate. We expect more from the metaphysical dictum because it does not, and cannot, rest upon experience.

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A SHORT ACCOUNT OF THE

Trip to Cape Sidmouth and Back,

IN THE

GOVERNOR BLACKALL, S.S.,

BY

MR. S. DIGGLES, BRISBANE,

Read before the Queensland Philosophical Society, on Thursday, February 22, 1872.

SOME months since this society received a communication from the Royal Society of Victoria, in which was suggested the desirability that the various Australian colonies should unite in forming an expedition to Cape Sidmouth for the purpose of observing an eclipse of the sun, which was to take place on the 12th December, 1871, and requesting that we should make enquiry as to whether any person or persons in this colony would be willing to join such an expedition. The probable expenses were also indicated. This society did not feel justified in sending one of their number, principally on the ground of the expenditure required, though fully agreeing as to the desirability of so doing, but thought it would be very proper to communicate with the government on the matter. Accordingly, the letter from the Royal Society was sent to the Colonial Secretary, in the hope that some scientific man might be selected from this colony to take part in the expedition. A reply was received to the effect that the government did not see their way clear to move in the matter, thus leaving it open to any persons desirous of going from Queensland to do so on their own responsibility.

The expedition had not then been actually determined upon, but subsequent steps were taken by the scientific men in Victoria and Sydney which resulted in the trip being made. The steamer Governor Blackall being deemed very suitable for the purpose, and also lying unemployed in Sydney Harbor, was applied for, and the use of that vessel was very liberally granted by our present government, who also went to a considerable cost in repairing her machinery, reserving to themselves the right of sending any gentleman they chose to represent Queensland in the Australian Eclipse Expedition, as it was termed. Captain O'Reilly was applied to, but pressure of business at the time precluded his accepting the engagement, but that gentleman recommended myself as one likely to be useful in various ways, chiefly as artist and naturalist, I think, adding that I was also accustomed to the use of the telescope, having been in the habit of assisting him in his own observations for some time past. The Colonial Secretary was pleased to accede to Captain O'Reilly's recommendation, and I was accordingly instructed to proceed to Sydney to join the expedition, which was to start from thence on Monday the 27th November, 1871. I left Brisbane on the morning of Thursday the 23rd, and reached Sydney after a fine trip of 42 hours from wharf to wharf. The passage was pleasant, and I must record the kindness shewn me by Capt. Knight of the City of Brisbane, who wished me all success on the trip.

Not having seen Sydney for about 19 years, I was wishful to ascertain whether I could easily recognise the scenes with which I was then familiar, and certainly found that a great alteration had taken place, many of the open parts which existed at that time having been built upon. The main features were there however, and I felt no difficulty in finding my way. After calling at the office of Messrs. Eldred & Spence, the agents for the Governor Blackall, who informed me they had secured me the necessary accommodation on board; I proceeded to the Botanical Gardens, curious to see whether Mr. Moore the manager would remember me after so long an absence from Sydney, and was gratified to find he did so. He informed me

he was going as Botanist to Cape Sidmouth, and regretted that our government had not sent Mr. Hill. I may here remark that I suggested the same before I left Brisbane, and believe that his (Mr. Hill's) services would have been of greater practical value than mine, as it turned out; the great object which I had laid out for myself (the delineation of the corona and chromosphere in their true colors) being defeated by adverse circumstances. After a pleasant chat I left, and proceeded to the Museum, where I was heartily welcomed by Mr. Krefft the Curator, whom I had corresponded with for years but had never seen personally. He insisted upon my remaining with him while in Sydney, and did everything in his power to make my visit agreeable. I spent many pleasant hours in his society, and he was most kind and attentive, affording me useful information on various subjects connected with natural history. Mr. Krefft's attention has been much directed to the study of Australian snakes, the most valuable and reliable information concerning them is to be derived from a work published by him a few years ago. The fossil remains of the extinct fauna of Australia occupy much of his study and attention. There are a fine series of fossil bones in the museum, and though broken and battered are not less valued. A large proportion of them were procured by himself from the Wellington Caves in New South Wales, and many have been received from Queensland, some of the larger specimens in particular; Mr. Krefft amused me much as he described the way in which he was enabled to discover the analogy between recent species and fossil; and in many cases he has the pieces of each arranged side by side, so as to completely demonstrate the truthfullness of his identifications.

The valuable library of the Institution was also used by me I hope to good purpose. I there had an opportunity afforded me of examining works heretofore only known to me by report, and many a pleasant hour I spent turning over the pages of such authors as Gould, Grey, Temmink, and others on Ornithology; and Dury, Hewitson, Westwood, Sepp, &c., &c., on Entomology. Amidst such a mass of information, I only regret that much too cursory an examination was all I was able to give to these works, and I longed for the time when we should have a similar library and a similar museum established among us in Brisbane. Mr. Masters the assistant curator was also very kind and attentive to me. He took me through all the rooms and shewed me the various collections, which were beautifully arranged and classified. This gentleman has done more to make the Entomologist acquainted with the insects, especially the Coleoptera of Australia, than any man living, and has of course an extensive acquaintance with them. He is often sent by the trustees of the Museum on long trips to different localities, where he frequently spends months at a time, always returning with a large accession of novelties. By Messrs. Krefft and Masters I was presented with various works and papers of which they were the authors, viz:—The Mammals of Australia and other smaller works, by Gerard Krefft; and catalogues of Insects by George Masters. The $2\frac{1}{2}$ days I was in Sydney, were, for the most part spent in the Museum. At about 5 o'clock p.m. of Monday, November 27, the expedition took its departure from Sydney Harbour in the Queensland steamer, Governor Blackall. I would here remark that few persons are aware of the loss they sustain in neglecting to call at the Museum in Sydney, any one going from Brisbane or any other part of Queensland, will do well to pay that noble institution a good long visit, and I will promise them a great treat. Mr. Krefft is very affable and shews visitors every attention, being a patient listener to any enquiry which is made, and very painstaking in explaining everything

The weather was fine when we started, and nothing of importance occupied our attention until we arrived at Percy Island, No. 2, about 3 in the afternoon of December 1. We anchored here for the first time and all went ashore, each bent on some object of interest, some to botanise, some to collect shells, some for anything that would turn up; my own particular intention being to collect all the new insects I could meet with. It will be remembered by some that a melancholy interest attaches to this island, as the locality where Mr. Strange was murdered by the blacks about 18 years ago, when in pursuit of specimens of natural history. He was a zealous and efficient collector and did much to render Australian natural history known to the world. I find his name occurring in the British Museum Catalogues as the discoverer of many species of insects, and he is frequently referred to by Mr. Gould as the naturalist from whom he received a number of the rare birds figured in his splendid work on the birds of Australia.

The shore of this island was a sandy beach, and a little difficulty was experienced in landing on account of the rollers; the boats seeming to have a great desire to get broadside on to the waves which, had they done so, would certainly have resulted in a capsize, but by dint of poling with an oar on each side of the boat all landed without other accident than here and there a wetting. There being no signs of natives, and many of the party being armed with guns which would shoot either birds or men (though only intended for the former), no repugnance was felt by any one to going any where, and different parties dispersed themselves in various directions. The island was hilly and well clothed with vegetation. The botanists made their way into the thickest part of the bush and were rewarded by the discovery of a variety of interesting specimens. My attention was first directed to a

species of convolvulus which had large succulent leaves and lined the sandy beach with its long trailing stems. I perceived that the leaves were a good deal eaten and found a very pretty species of Cassida or Tortoise Beetle in great numbers. It turns out to be a species identical with some I have had sent to me from Cardwell. I searched very assiduously but in vain, for a long time, for other specimens but with the exception of an interesting Longicorn Beetle I got nothing of importance. A nest of turtle's eggs was found in the sand. Climbing a hill I came suddenly upon a steep slope of loose earth and stones, down which I found a number of our party must have scrambled. On reaching them I found them busily employed knocking oysters from their native rock. They were pronounced, though small, very sweet, and seemed like the rock itself, being so embedded and attached as to be completely disguised, and I gave credit to their discoverer for his sharpsightedness. It was now getting towards dinner time and a signal was fired for us to rejoin the vessel, one loiterer only being left behind and a boat sent for him subsequently. On the summit of this island was a square piece of rock so situated as to present a forcible resemblance to the ruined turret or keep of some gigantic castle.

We started from our anchorage on Saturday, December 2, at sunrise. A numerous group of rocky islets next met our view (the Beverley Group), fourteen or more being visible at once. At noon we came upon the Cumberland Isles, which were, some of them, large and lofty; one summit being 874 feet high, according to the chart. From the contour of these islands it is evident that they form the summits of a range of submarine hills. Some portions of these islands were densely clothed with pines (the common Moreton Bay species), but which appeared to be of no great size. The next object which met our attention was Whitsunday Passage, a piece of exquisite scenery which many an artist would give a good deal to have an opportunity of depicting; but as the vessel was sailing rapidly, the utmost I could do was to make of it a rough panoramic outline. Beyond this part of the coast the scenery becomes more grand and impressive, the summits of Hinchinbrook Island ranging from 2990 to 3650 feet. This day being Sunday, divine service was conducted in the morning by the Rev. W. Scott, of Sydney. The water of the sea exhibited a marked change in color, being of a beautiful light blue tint. Passing the Barnard Islands I was reminded that here and on the opposite coast were procured, by Mr. MacGillivray, the rarest of the three species of rifle birds, *Ptiloris Victoriæ*. This species still remains comparatively unknown, and specimens are valuable. Any collector spending a day or two among these islands might be well repaid for so doing, as, no doubt, a very high price would be obtainable for specimens of the birds alluded to. It is to be hoped that Mr. Cockerell, in his adventurous trip in the "Naturalist," has not neglected these islands, as, should he meet with the rifle bird in question, any skins obtained by him would be very carefully prepared, and some of them might chance to come into the possession of the Queensland Museum.* The navigation from this point being less known than the waters to the south some anxiety was felt by the passengers at our sailing after dusk, and Captain Gowlland, more in deference to their feelings, than from any fear on his own account, anchored our vessel at Frankland Island.

Starting early next morning, 4th December, we soon came upon a scene which attracted all eyes, when, at 7.30 a.m., we anchored in a beautifully sheltered bay at Fitzroy Island. Our water being nearly exhausted it was determined to call here for a supply, which we were informed was excellent in quality and easily accessible, as it proved, being scarcely a hose length from the sea side. The beach was composed entirely of fragments of broken coral and emitted a musical or tinkling sound as we walked over them. Though sea worn and smoothed by mutual attrition, they were sufficiently file-like to be very destructive to boots and shoes. The beach sloped pretty suddenly and a little higher up was formed of finer material, but all from the same source and was much intermingled with trailing plants and creepers, with here and there blackened blocks of coral projecting, thus shewing recent elevation. A number of interesting trees were also observable, which tended to give much variety to the scene, and across a flat covered with coarse grass and other plants we came upon the creek from which our water supply was obtained. This creek flows down a valley between the two principal summits of the island, and yields a good supply at all seasons. I did not visit the eastern side of the island which, Mr. Hill has since informed me, is much more prolific in botanical desiderata. The insect tribes were holding high holiday on our arrival, and I was enabled to capture a considerable number of specimens, principally Lepidoptera, several of which, though not new to me, were not to be found so far south as Brisbane. At the north-west and also at the south-west portion of the island were a fringe of huge water worn granite boulders, which from the deck of the steamer, looked small enough; but, when we visited them proved to be of huge proportions. They were mostly of a light buff color and looked like sand stone at a distance. The heat was oppressive, and while we were on shore a heavy shower came on. The crew finished watering towards evening, when all returned on board. Several beautiful birds were shot, which were brought to me for ex-

* I believe Mr. C. spent several days here on his trip up, and obtained a good many specimens.

amination, none being strange to me excepting the Torres Straits pigeon, which here made its appearance for the first time. Mr. Walter, a photographer, from Melbourne, took several interesting stereoscopic views during our stay. We weighed anchor next morning at daybreak, and about noon were opposite the Endeavour River, celebrated as the spot where Captain Cook hove down his vessel for repairs, having previously struck upon a coral reef to the southward. The coast, near the river, consisted of two hills rising in a sloping direction from the water, but near the top assumed a precipitious aspect as the rock cropped out perpendicularly. Coral islands nearly level with the water now became numerous, and were generally clothed with low bushes and other scanty vegetation. At 5 in the afternoon we arrived at our next anchorage, Lizard Island, which was a desolate looking, though picturesque spot. Some went on shore, but I preferred remaining on board and occupied myself in making a sketch of the scene. When our friends returned, they reported having seen signs of inhabitants. Footprints of men, a child, and a dog were found imprinted on the sand, and the remains of a stone building, with a black cross marked on the wall, surmounted with a large D. This is supposed to be a station formerly used by collectors of beche-le-mer, so much used by the Chinese in making soup; but to the uninitiated the animal is anything but prepossessing in appearance, being like a huge slug, from a few inches to a foot or more in length. There are various qualities, some fetching a high price, and the pursuit is said to be a very profitable one. Not much was found on this island, the botanical collectors being the most fortunate. A few grasshoppers of large size, but similar to some too frequently found in our Botanical Gardens, were all that were seen among the insect tribes. Had it been earlier in the day I might have possibly met with something worth capturing.

We started next morning at 6 a.m. and reached our destination, which was an island of the Claremont Group, called No. 6, distant about 9 miles from the main land. The weather up to this time having been so temptingly fine, it was thought that being so near the centre of the totality of the eclipse, better work could be done by all keeping together. No fear seemed to be felt and no doubt expressed that any failure was likely to result from our doing so. The next 5 days were occupied in making the necessary preparations for mounting the various instruments which were to be employed. The first thing to be done was to build solid piers on which to fix them, this was very well and efficiently done, bricks firmly set in cement being the materials employed; Mr. Casselli, an architect from Ballarat, was the gentleman who erected them. We enclosed in glass bottles, as a memento of our visit :—several newspapers from the different colonies of Australia, a list of the passengers, and a few coins, which were securely imprisoned within the different piers. The instruments used were of the best construction, and most accurately adjusted; and in all cases exhibited a freedom from tremor highly satisfactory. Mr. Russell, from the Sydney observatory, brought with him the large 10 feet Equatorial, by Merz, and I had the pleasure of witnessing the whole process of its erection. This instrument has an object glass $7\frac{1}{2}$ inches in diameter, and is of excellent quality; and though of considerable weight is very easily handled, the ingenious system of counterpoises attached rendering it capable of being moved by one hand, but steady as a rock, even with the highest powers. There were also two small instruments of 2-inch aperture, one of which was placed at my disposal, and the other that of Captain Gowlland. These like the large telescope were moved by clock work, and I had here for the first time an opportunity of examining a new description of regulator, which the ingenuity of Mr. Russell has devised, for timeing the motion of the telescope to the speed of the heavenly bodies. As this varies indefinitely according to the declination, an easy and effective means of regulating the speed is of great importance, and still more when combined with simplicity of action, which is the case with Mr. Russell's invention; being merely the immersion of a wooden wheel in a trough of mercury, under which is a regulating screw, which causes the wheel to dip more or less deeply into the fluid. The quickness and certainty of action thus attained is marvellous, and a very short time only is necessary to bring an object steadily on the wire of the finder. Another and larger telescope, by Troughton and Sims, was devoted to the Rev. Mr. Scott, and was fixed to a post, firmly embedded in the sand, and equatorially adjusted. These instruments were connected with what was called the Sydney tent, which was of a size sufficient to cover all the apparatus, and also enclosed in its ample folds a dark room for Mr. Merlin the photographer. The Melbourne astronomical party had a larger amount of apparatus and several smaller tents. I noticed one of the new silver on glass reflecting telescopes, by Browning and With, of 8 inches aperture, mounted equatorially, attached to which was a powerful spectroscope, specially arranged for viewing the spectrum of the corona. Proffessor Ellery and Mr. Black Geodetic, surveyor of Victoria, attended upon this instrument. Two other spectroscopes were in the charge of Messrs. Macgeorge and Foord. A fine transit instrument was used by Mr. White, who was at great pains to secure accuracy in its adjustment. Other instruments, and a variety of photographic apparatus were all duly prepared, and practice in the art of photographing to the beats of the chronometer was well attended to, to ensure

the necessary dexterity and precision when the important hour arrived. Everything was done that could be done to ensure success. A number of cards with a black disk in the centre, intended to represent the dark body of the moon at the time of totality, were prepared, and each observer provided with one or more for the purpose of marking in outline any peculiarity which might be observable in the prominencies, corona or chromosphere. Every one was requested to act independently, and to delineate only what was impressed upon his own mind; a scale of two colors of different intensities, from one to ten, was also provided for reference, in order that while the impression of the scene was fresh in the memory, each observer might select such as appeared most true and appropriate, in the various portions of the sketches made.

The days were employed by a number of our voyagers in collecting shells or taking short sails in the neighborhood of the island. One party consisting of five passengers and two servants with three of the crew, went the day after our arrival to the mainland; on the second day Captain Gowlland went to see how they were getting on, as the Captain of a vessel which anchored near us reported that the trip was very hazardous on account of the ferocity of the natives. He (Captain Gowlland) returned in the evening, reporting that he had met with them, and brought back with him one gentleman who was anxious to return, and leaving another behind. The first party made an attempt to follow some time afterwards, and did not succeed, having to return and spend a miserable night in an open boat, exposed to torrents of rain. They arrived safely next evening, wet, tired, very hungry, and thirsty, and glad to be on board once more. The country was reported as barren and uninviting, and very destitute of water. The botanists, however made some interesting discoveries, one in particular being that of an edible fruit of good flavor, of which they ate a good many. The pitcher plant was also found and some other interesting shrubs. Ant hills of a curious and unusual structure, and of considerable size were also noticed, they were some of them 8 or 10 feet high, and arranged like spires or pinnacles, around a central part. What few natives were seen rapidly decamped, and Mr. Moore the botanist affirmed that he would not hesitate to land again with two men only to accompany himself and two to take charge of the boat.

The morning of the 11th December was a curious one. I was on deck about daybreak and much struck with the appearance of the sunrise. It was of a character I had seldom seen, being much more like a sunset than a sunrise, the clouds being gorgeously colored with all kinds of brilliant tints, red, yellow, and purple. I believe it occurred to me that a sunrise of this kind portended bad weather. The day throughout was unsettled and in the evening a severe thunder storm was experienced, which might have resulted in damage to the ship had she been built of wood. Being a natural conductor no harm was done, though the impression on the minds of all was that the vessel was struck more than once by the lightning, the vivid flashes of which were simultaneous with the thunder claps. Some were of opinion that the weather would clear for the morrow, but the dawn of the great day was anything but promising. During the course of the morning large patches of blue sky were visible from time to time, any one of which would have sufficed for our purpose, if happily favored with such an opening. But as the time drew near the clouds closed in more and more, and scarcely a glimpse of the first contact even was obtainable. As the time for the totality approached the rain, which had been threatening, came down, and we then saw that no observation was possible. With feelings of deep disappointment the instruments were covered over, for protection, and the scene soon closed. Directly it was known the totality was over, great exertions were made to dismount and pack the instruments in their various cases, and everything was secured and shipped before dusk. We left behind us the brick piers and the wooden photographic room, which will form a conspicuous object on that desolate spot, perhaps, for some time to come. On anchoring at Eclipse Island, as it will hereafter be called, great doubt was expressed by some as to whether it was No. 6, Claremont Group, but Captain Gowlland smilingly told them to wait for low waier and then they would see for themselves. At high water nothing is noticeable but a bank of coral sand about eight feet high in the middle, perhaps three quarters of a mile in length by a quarter of a mile in width. A few scanty shrubs and bushes were the most conspicuous objects, creeping plants trail along the ground, and were intermingled with tufts of a brown coarse grass which present a burnt or scorched appearance; but at low water, a tract of flat coral, five miles in extent and covered with shells, etc., is exposed to view, and many of the tourists availed themselves of the opportunity then offered to augment their collections. Seafowl existed here in great abundance, and on our arrival were shot in some number, but speedily became very wary and shy. Here I had the pleasure of seeing the rare Egret, *Demigretta Greyi*, for the first time, and took a sketch of it. The remainder of the species noticed by me were of common occurrance, consisting of Dotterells, Sandpipers, Oyster Catchers, Pelicans, and Terns. Insects were almost absent, even the common house fly was seldom, if ever, seen. A very few species of small coleoptera and a pair of pretty moths rewarded my search. Rats were plentiful

and proved to be the common species. A creeping vine was found, which bore the beautiful shining red and black seeds sometimes used for necklaces. A large yellow flower, something like a buttercup, was seen and pointed out by me to Mr. Walter, who was collecting for Dr. Mueller, of the Melbourne Botanical Gardens. One solitary Casuarina, stunted and broken, struggled for existence. Numerous curious nuts and fruits were cast up on the eastern beach, derived, no doubt, from the islands of the Pacific, and quantities of shells, more or less perfect, were to be seen; from the pretty spirula, like the volute of an ionic capital, to the shell of the pearly nautilus. Some fine Tritons were procured on the reefs around, and a number of curious star fish and holothuriæ were collected. One of the star fish was of a beautiful light blue tint, but fades to a light buff. During our stay at Eclipse Island we had a fine bit of sport with the sharks. Broad-headed, shovel-nosed monsters, they were from 9 to 12 feet in length. Three specimens were hauled aboard and about seven others shot in the head with rifles and then released. Many who had been in the habit of taking headers from the ship's side, ceased from this time to do so. From the great number of these animals and the ease with which they are captured, I feel convinced that a good trade might be carried on in the oil which the livers furnish in large quantities. Our sailors amused themselves in preparing and cleaning the jaws and backbones, which are the only solid parts belonging to them. I took several parasites from these monsters, one was a curious leech of very large size and beautifully mottled with black and green, very much like the markings on a snake; another was a brown fluke, about an inch in length, oval in shape, and quite flat; a third resembled the common white cylindrical worm, often found in the intestines of animals and even the human species, but was deeply imbedded in the muscular tissue from which I had some difficulty in extracting it. These specimens I forwarded to Mr. Krefft, of the Sydney Museum, who is at present engaged in their study and has already published a paper, with illustrations on the subject. I only obtained a few land shells, and might have been more successful in my searches for them had I been better acquainted with their habits, but Mr. Brazier, of Sydney, obtained a good many, some of which were rare and of considerable interest.

The evening before we took our departure from the scene of our heavy disappointment, we were visited by a schooner, which anchored near us. She proved to be the Matilda with a number of South Sea Islanders on board, and the captain of a vessel which was wrecked in Torres Straits. The latter was permitted to remain with us, as he wished to obtain assistance from Sydney as soon as possible. The captain and mate of the schooner reported that at no great distance, perhaps 10 or 15 miles, they had a good view of the eclipse, which took them completely by surprise and they were not prepared to make any observations likely to be of any scientific value. But the account which they gave was consistent and rational enough, and they stood a long and separate examination at the hands of Professors Ellery and Wilson, remarkably well; forcibly shewing that had we been as favorably circumstanced we should have had a great success. One of our gentlemen, an ardent collector of sea-shells, visited the schooner in hopes of meeting with something good and rare, and paid handsomely for many specimens which, I was informed, could be had at a very reasonable rate in Sydney.

Next morning we started early and made a good run, reaching No. 6 Island, of the Howick Group, where we anchored at about 5 o'clock in the evening. Two boats went from the vessel's side, but only one of the parties managed to get ashore by wading through the water, which the others declined doing, and contented themselves with the services of such seamen and assistants who did not object to submerging themselves, and for which services they, doubtless, were paid well, as a number of beautiful specimens of coral were obtained here; in fact nothing got before could compare with them. They were of various species, some very beautiful. Among the branches were afterwards detected a number of small crabs and shells, which Mr. Brazier very industriously fished out and preserved. The party who succeeded in effecting a landing found a few botanical specimens, as the island appeared to be well wooded, and mangroves, which we had not seen much of hitherto, were plentiful around the beach. At night the deck smelt decidedly fishy, and some objection was made to specimens lying about. There was great call for old packing cases and empty barrels, which the purveyor, Mr. Crookes, would doubtless profit by. The evening was spent on deck in a very pleasant manner, and a number of those musically inclined, gave us a specimen of their abilities, some very good songs being sung on the occasion. Next day we started early, and passed Lizard Island about 10 a.m., and about 4 o'clock p.m. a range of high mountains near Cape Tribulation. The summits of many were cloud-capped and therefore invisible, but must have been very high. This part of the Australian coast has a greater elevation than any other part of Queensland, and with the exception of the Australian Alps, to the north of Victoria, is doubtless higher than any other part of this continent. Some of the summits of the Bellenden Ker Range are said to exceed 5000 feet in altitude, and lie a little to the south of our then present position. The atmosphere being hazy it was deemed prudent to anchor at night, which we did in the open sea, which was smooth and not deep,

so that there was scarcely any swell. The young moon was beautiful, bearing in her pointed arms the dark bottle green body of the old moon, in which was distinctly visible some of the more prominent features of the lunar landscape. Next day we arrived at Fitzroy Island to take in water, and arriving when the tide was high had the mortification to find that the supply contained in our splendid waterhole was all salt. A search was made, and a little further to the north, and also not much farther up the beach, was a shallow rivulet, surrounded by trees, which was quite suitable, and during the day we obtained a good supply. I again captured a few insects, but they were much scarcer than before. I got more coleoptera on this occasion, but very few specimens of any kind, the rain which probably extended to this locality having, in all probability, killed them. We started the same evening and arrived on the morning of Saturday the 16th December, at Cardwell, at an early hour. On coming to the anchorage we looked for some signs of recognition on the part of the inhabitants, but none seemed to take any notice, and the only course for us was to land and send off telegrams, which was the great object of our calling in at Rockingham Bay. The telegraph master had a busy time of it, and is not likely to be so overworked for a long time to come; but he went through the ordeal bravely, and I have not heard of any mistakes. I had an opportunity of calling upon several gentlemen here, whom I wished to see, and had some nice insects presented to me by the family of Mr. Baird, the agent for the A. S .N. Company. Mr. Baird was away with the pilot and pilot boat on a visit to the Herbert River, which lies to the south, and is the site of some fine sugar plantations. Cardwell is well situated, but would be much improved by the erection of a jetty similar to the one at Bowen, as it is now all goods have to be taken on shore in boats, which in rough weather must result in loss or injury to delicate articles. The bay is exposed to N.E. winds, but is otherwise well sheltered. The town is a string of houses all in line, parallel to and a short distance from the shore, which is a clean sandy beach, from which even at high tide any amount of fine fresh water is obtainable by digging a small hole. I called upon Mr. Sheridan, the Police Magistrate and Collector of Customs, who shewed me a beautiful tree near the beach, under the shade of which our present governor received the adresses of the inhabitants. It is a fine evergreen, something like the Moreton Bay fig in appearance, and bore quantities of fragrant white blossoms. Mr. Bosisto, a chemist, from Victoria, remarked that he would be able to distil a fine scent from these flowers. The pine apple and banana grow well here, and our voyagers took the opportunity of securing an ample supply. The land about Cardwell seems to be of good quality, and the hills behind, which rise to a considerable elevation, do not seem many miles distant; they are thickly timbered and much add to the appearance of the town, as viewed from the bay. The view from Cardwell is truly magnificent, to the east is Gould Island, and southward lies Hinchinbrook Island with its lofty and rugged peaks. Had I had time nothing would have given me greater pleasure than to have made a drawing of the scene. We left early in the afternoon and proceeded on our voyage, this being our last place of call before reaching Brisbane. We passed Port Denison next morning about half-past 9 a.m., and shortly afterwards were surprised by the captain ordering the sudden stoppage of the vessel, which seemed to be running upon a sand bank immediately ahead. After a few minutes the signal to go on at full speed was given, and the cause of the alarm was made evident when a bucket of water was obtained from the sea, which was discolored in many places over a large area. On examination, it was found filled with small particles of some substance which the microscope showed to possess an organization similar to marine algæ, which it doubtless was, as the cellular structure was sufficiently evident. The difficulty consisted in believing that the same could be so regularly and uniformly broken into fragments, all of the same apparent size. None were more than about the fortieth of an inch in length, and under a pocket lens resembled oat grains in shape. The vast accumulation of this substance was astonishing, and we observed the same phenomena on the two following days. The sea was totally discolored, as if clay had been stirred up and was held in suspension by the water. I procured some of the substance by dipping a sheet of paper in the bucket of water, and the particles readily adhered, and were fimly attached when dried. From this time until our arrival in Moreton Bay, nothing of note occurred. We made the north entrance late in the evening of Tuesday the 19th December, and were boarded by the pilot, who took us to the anchorage, where we remained for a few hours till the tide rose; when, entering the Brisbane River, we arrived at about 6 o'clock in the morning of the 20th. The rest we all know, how the government entertained the visitors and gave them a trip to the Downs, etc., and sent them away with a very favorable impression of this the gem of the Australian colonies.

The trip throughout was a very pleasurable one, and the various scenery through which we passed called forth the admiration of all, from its variety, novelty, and beauty. The steamer did her duty well, averaging ten knots an hour throughout the passage. The company were all agreeable and a greater amount of rational and instructive conversation, perhaps, never was enjoyed by any set of tourists. A number of valuable astronomical works were more

especially read and studied on the trip northwards, but on our return a decided tendency was entertained for reading of a lighter description of literature, more especially among the gentlemen of a less scientific turn of mind. The amusements were various, chess, backgammon, whist, quoits (made of rope), &c.; and a few "chiels" were now and then to be observed "takin notes," the substance of which many of us have, doubtless, had the pleasure of perusing. I might have said much more, but so many accounts have appeared in different colonial newspapers, that anything incomplete in this paper may be easily supplied from those sources. It is a matter of some interest to compare the various accounts, one in particular, which appeared in the Ballarat Star, of January 1, 2, 3, and 4, is well and facetiously written. Being the only Queenslander on board, many enquiries were made by the voyagers as to our mines, plantations, railways, etc., which I hope I was able to answer to their satisfaction. Among so many mathematical men it was necessary to be cautious, and I took good care not to commit myself by any statements of which I was not certain, not being as well up in statistics as was desirable in such a case, and deeply regretting that I had not brought with me such works of reference as would have satisfied more fully their enquiries; but as they were coming on to Brisbane, I told them they would have abundant opportunity of getting all the information they required on arrival. Speaking of gold mining, it was mentioned that companies in Victoria found it profitable to crush quartz yielding only three pennyweights to the ton. I remarked that any reef not giving an ounce, or more, would not be worked in our colony, and that there were plenty of such going a begging, and that if they wished to invest their capital a far better field was open to them here than in Victoria. Great prejudice was manifested by most against the narrow railway guage, which has proved such a success in this colony, one very scientific gentleman affirming that nothing under seven feet ought to be adopted. I hoped that he would have an opportunity afforded him of seeing our own, and endeavored to show that the vastly diminished expense of constructing such a line, especially in a hilly country where short curves were inevitable, was no light consideration in a young colony like ours. I believe the trip they were enabled to make, through the liberality of the government, has gone far to dispel the prejudices entertained by our southern visitors.

The sketches I made were few but interesting, and would be pronounced untruthful in some instances, as where the color of the sea is represented of a bright cerulian blue; this, I affirm, is as I saw it, and it was truly beautiful. Some photographs of scenes I had no opportunity of depicting, I hope shortly to receive from Mr. Walter, of Melbourne, and Mr. Merlin, of Sydney; when I hope by their aid to make some other interesting water-color drawings and to lay them on this table on a future occasion.

I here append a list of the various insects which I procured :—Lepidoptera : Acröe Andromache, common on Fitzroy Island; Danais Archippus, common at Cardwell; Euplöe Darchia, two specimens (Fitzroy); Junonia, Orythia, and Velleda, the first of these was plentiful at Fitzroy Island; Papilio Sarpedon, was seen also but not captured; Papilio Capaneas, two specimens; Terias, the common species, was very plentiful, as were several small blue butterflies; a fine species of Thecla, two specimens; but most abundant was the beautiful Diadema Alimena, of which I obtained a good series of both sexes. Coleoptera were scarce, but I got a few which were new to me. I much regret losing a beautiful Cetonia which I caught in the net, but on trying to release it from the folds it slipped through my fingers and escaped. It was of a brilliant metallic green, and I think would have proved to be Schizorhina Insularis, of which I possess a single specimen from near Port Denison.

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QUEENSLAND PHILOSOPHICAL SOCIETY.

THE PITURI POISON.

A Paper read by Dr. Bancroft, before the above Society, on Thursday, 28th March, 1872 :—

A meeting of the Queensland Philosophical Society was held on Thursday, March 28, at which Dr. Bancroft read a paper on the "pituri" poison, brought by Mr. Sub-Inspector Gilmour from near Cooper's Creek. Some interesting experiments were made, demonstrating the deadliness of the poison to small animals. The paper will appear in an early issue. Mr. Pettigrew showed some stone which, on heating, resembled porcelain. This may probably be of value in the manufacture of superior kinds of pottery. It was found by Mr. W. P. Clarke, near the Maroochie River.

Dr. Bancroft said :

On February 9th of this year, I obtained from Mr. Gilmour a quantity of dried leaves, and the particulars here narrated, of a plant used by the natives as a stimulating narcotic. These leaves, called "pituri," were obtained in the neighborhood of the water-hole Kulloo, eight miles beyond Eyre's Creek.

The use of the pituri is confined to the old men of a tribe called Malutha, all the males of which tribe are circumcised.

The pituri is carried in neatly-made oval pointed bags, specimens of which Mr. Gilmour has brought.

The old men, before any serious undertaking, chew these dried leaves, appearing to use about a tablespoonful. A few twigs are burnt, and the ashes mixed therewith. After a slight mastication, the bolus is placed behind the ear—to be again chewed from time to time—the whole of which is at last swallowed. The native, after this, is in a sufficiently courageous state of mind to fight, or undertake any serious business.

One old man Mr. Gilmour and party fell in with refused to have anything to say or do until he had chewed the pituri ; after which he rose and harangued in grand style, ordering the explorers to leave the place. The pituri caused a severe headache in persons who tried it. The dust given off in examining the leaves causes sneezing.

The above is the information supplied by Mr. Gilmour.

Mr. Wills' diary from Cooper's Creek homewards (page 283) has the following :—"May 7, 1861. In the evening various members of the tribe came down with lumps of nardoo and handfuls of fish, until we were positively unable to eat any more. They also gave us some stuff they call bedgery, or pedgery ; it has a highly intoxicating effect when chewed even in small quantities. It appears to be the dried stems and leaves of some shrub."

The pituri consists of leaves broken into small particles, and mixed with it are acacia leaves, small dried berries containing reniform seeds and unexpanded flower buds of the shape of a minute caper.

The seeds picked out have as yet not germinated, indeed have decayed ; and from this reason, together with the brittle and broken condition of the leaves, causes me to suspect that they have been dried by artificial heat. I do not, however, find any scorched leaves or burnt matter mixed therewith. Mr. Gilmour also gave me a small bunch of twigs, some as thick as a pen-holder ; these appear as if broken from a tree. The leaves are narrow lanceolate, and when complete may be an inch long and an eighth of an inch broad. It is impossible to find an entire leaf.

On February 22, I made an infusion of one drachm of the pituri in one drachm of water. Of the solution obtained, thirty drops were injected under the skin of a half-grown cat ; the animal died from suffocation in one minute, the heart continuing to beat for some time afterwards. Seven drops of the same solution injected under the skin of a puppy caused death

by suffocation in a minute and a half, the heart continuing to beat as before. The same quantity killed small rats with great rapidity.

On March 3, I commenced experiments with the extract obtained by evaporating the watery infusion. The extract is of the consistency of treacle, and can be conveniently dropped from n ounce vial.

By evaporating the infusion carefully, minute crystals are formed in great plenty. The crystals are acicular bundles, and are beautifully tinted by the polariscope.

In the infusion is generated a yellow matter, which falls to the bottom of the vessel. This yellow substance has no poisonous properties. The extract also undergoes this change generating carbonic acid by fermentation. A yellow deposit also goes to the bottom. This, as in the case of the infusion, contains large compound spherical cells, also crystals, which are probably the active principle. The poisonous effects are not destroyed by fermentation.

On frogs, a solution of the extract acts speedily, if applied to the skin. Increased activity of respiration occurs, followed by torpidity; during which the frog can be placed in curious attitudes, from which he will make no efforts to move. The web of the foot can be placed under the microscope, to examine the circulation of the blood, very conveniently when in this torpid state; the heart continues to beat feebly for many hours. Frogs will recover after twenty or thirty hours of this condition of inactivity. Grasshoppers will come to life again after an apparent death of two or three days.

The warm-blooded animals will not recover if respiration be not re-established very shortly after the suffocative attack.

When from a quarter to half a drop of the extract diluted with water has been injected under the skin of a rat, the following symptoms are observed :—In less than one minute, the animal becomes very excitable, and jumps and starts with the slightest provocation; it appears to have lost the power of restraining itself. Shortly, irregular muscular motions occur, passing rapidly into a general convulsion. The animal opens its mouth as if longing to breathe, but no regular respiratory act follows. Opisthotonos is well marked in some cases. After a few seconds of quiet from muscular effort, during which the heart may be seen to act powerfully, a gasp for breath follows, which is generally a sign that the poison will not prove fatal. This is succeeded by others, and very shortly rapid respiration takes place of a feeble kind. The animal now gradually regains consciousness. The respirations fall to the normal standard. Weakness and torpidity remaining for several hours, during which, however, voluntary exertion takes place with very little stimulus. In two instances death took place during this period of torpidity.

The effects of the pituri are—

1st. Period of preliminary excitement from apparent loss of inhibitory power of the cerebrum, attended with rapid respiration; in cats and dogs, with vomiting, and profuse secretion of saliva. In dogs there is retraction of the eyeball.

2nd. Irregular muscular action, followed by general convulsion.

3rd. Paralysis of respiratory function of medulla.

4th. Death or

5th. Sighing inspirations at long intervals.

6th. Rapid respiration and returning consciousness.

7th. Normal respiration and general torpidity not unattended with danger to life.

The poison, given by the mouth, acts with less vigor; injected into the intestines the results are more certain. The animal has a longer stage of excitement, the convulsive fit is not so severe, and recovery is more certain. Torpidity remains for some hours.

A quarter of a drop injected under the skin of a rat, causes excitement, the animal starts with slight noises, may fall over a few times from very strong muscular irregularities; remains excitable for some time, then gradually becomes torpid.

In small medicinal doses we may expect to find the period of excitement and the torpidity to be the only marked symptoms. In cats and dogs the excitement is not marked, but vomiting of a violent kind occurs.

Mr. Moffatt, chemist, of Brisbane, has a small quantity of the pituri. The distance of the neighborhood from which it was obtained causes me to hope that before long seeds of the plant may be collected, and some exact botanical knowledge of it, and the localities in which it grows, may be forthcoming.

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Philosophical Society of Queensland.

BYE-LAWS.

I. The Philosophical Society of Queensland shall consist of a President, Vice-President, Three Trustees and Council, a Treasurer, Secretary and Two Curators, of Members, and Honorary and Corresponding Members.

II. At any meeting of the Council or the Society the Senior Officer present shall preside, and in the absence of any officer, a Chairman shall be elected by the meeting.

III. The Treasurer shall receive and place in the Bank all moneys collected, and shall disburse such sums as may be authorised by the Council by cheques signed by himself, and countersigned by the Secretary.

IV. The Secretary shall conduct all correspondence of the Society and Council; record all proceedings; keep all archives, and superintend the Reading and other Rooms, and the printing of the Memoirs. He shall have the custody of all books belonging to the Society, and shall issue notices of meeting to the Members of Society and Council respectively. Such notices to be issued not less than three clear days previously to the date of such meeting.

V. On the name of a candidate being proposed and seconded the annual subscription of One Pound or the Composition Fee shall be deposited with the Secretary on his behalf; such name shall be suspended in the Society's room, and remain till the next meeting, when if elected by at least two-thirds of the Members present, the candidate shall be declared a Member; but no ballot shall be taken in the absence of the above deposit. If the candidate be not elected no record shall be made thereof, and the deposit fee shall be returned.

VI. A member on signing a declaration that he will observe the Bye-Laws, Rules, and Regulations of the Council and Society, shall, in the name and on behalf of the Society, be formally admitted by the Chairman at any meeting.

VII. The annual subscription to the Society shall be One Pound payable in advance on the 1st of January in each year; but the payment, of a fee of Five Pounds shall constitute Life Membership. Members elected after the 1st of July shall pay ten shillings subscription for that current year.

VIII. If at the expiration of three months from the 1st of January in each year the subscription of any Member be still in arrear, the Member shall be considered to have retired from the Society, but on applying to the Council in writing, and payment of One Guinea, such Member may be reinstated. Any Member whose subscription is in arrear shall be precluded from taking part in the Society's meetings.

IX. Honorary and Corresponding Members shall be proposed, with the sanction of the Council, by at least three Members of the Society, who shall specify in writing the grounds on which they are proposed. The election shall take place by ballot, subject to the same conditions as the election of ordinary members. Such members to have no vote at any meeting involving the expenditure of money.

X. The Council may enquire into any alleged misconduct of a Member, and if such allegation be established, the Council may by the authority of a Special Meeting before whom the facts have been laid, cause the erasure of such Member's name from the books of the Society.

XI. The Property of the Society shall be vested in Trustees, but no disposition of reality shall be made without the authority of a Special Meeting.

XII. The Council shall consist of the President, Vice-President, Treasurer, Secretary, Two Curators, and Four Non-official Members, who shall retire annually but be eligible for re-election.

XIII. The Council shall have the sole disposal of the funds of the Society, and do all such acts as shall appear to them necessary to carry into effect the objects and views of the Society.

XIV. All papers read before the Society shall be considered the property of the Society, and can be published only with the sanction of the Council and the authors.

XV. The Council shall meet at least *once* in every month, and not less than three shall form a quorum.

XVI. No motion shall necessarily be entertained of which due notice has not been given at a previous meeting.

XVII. At the first meeting in December, after the transaction of the ordinary business, the following shall be the order of procedure :—

1. The accounts audited shall be presented.
2. The Council shall report on the state of the Society, and its proceedings during the year.
3. The President will deliver his annual address.
4. The Council and Officers shall be elected,

XVIII. The Secretary shall prepare, and on the day of election suspend in the Society's room, a list of the ordinary members of the Society, and from such list alone shall the Officers and Members of the Council be chosen.

XIX. On the written requisition of three members of Council, or of six members of the Society, the Secretary shall convene a Special Meeting, giving not less then seven clear days' notice of the same, and stating therein the business to be transacted.

XX. To effect any alteration in the existing Bye-laws, it will be necessary that the Secretary give at least seven clear days' notice of meeting for such purpose to each Member, setting forth the proposed alteration. But no alteration shall be made at any meeting unless *nine* Members at least be present, and no alteration is to take effect unless carried by a majority of not less than *two-thirds* of those present.

XXI. The meetings of the Society shall be held on the Thursday nearest to the full moon in each month. The chair to be taken at 7.30 p.m., and no new business shall be entered upon after 10 p.m. The business of each meeting shall be conducted in the following order:—

1. The minutes of the last meeting to be read, amended if necessary, and confirmed.
2. New Members to enroll their names and be introduced.
3. Members to be proposed.
4. Ballot for Members.
5. Presents acknowledged.
6. Business arising out of the Minutes.
7. Communications from the Council and other correspondence to be entertained.
8. Motions of which notice has been given to be considered.
9. Notices of Motions for next meeting to be given and read by the Secretary.
10. Paper to be read and discussed.

XXII. In all cases of voting a ballot may be demanded.

XXIII. The Chairman at any meeting shall have a casting vote in addition to his single vote as a member.

XXIV. All donations to the Museum or Library, and the name of the donor, shall be recorded in the Society's Transactions.

C. MILLS, PRINTER, "EXPRESS" OFFICE, QUEEN STREET, BRISBANE.